

HORTICULTURAL ABSTRACTS.

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No. 1.

Universal Classification Numbers. To meet the expressed wishes of only three readers it has been decided to continue the use of the universal decimal classification numbers at the head of each abstract during the present volume. The Editor feels that continuance in subsequent volumes should have greater justification than this and he invites correspondence on the subject.

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Author Index. In the past only the first name appearing at the head of any particular publication abstracted has been indexed. In future, so far as is reasonably possible, all names of authors will be indexed.

Abstracts. Initialled abstracts in the present number are by W. A. Bane, A. B. Beakbane, S. C. Pearce, H. L. Pearse, W. A. Roach and W. S. Rogers of the East Malling Research Station.

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Horticultural Abstracts

Vol. VIII

March, 1938

No. 1

HORTICULTURE—MISCELLANEOUS.

1. BOBKOV, E. V. 631.811.9
The importance of minor elements in the control of plant disease.
Sovetsk. Bot., 1937, No. 3, pp. 80-9.

This is a report of a meeting held at Tashkent in November 1936. The following notes are taken from the author's summary of the conference proceedings. 1. The minor elements are very important in plant nutrition and must be present in sufficient quantities in the soil. 2. In the geographical study of the incidence of plant diseases the soil conditions at the most important centres of infection need particular study. 3. A study of the minor elements affecting disease resistance is essential and investigations should initially be directed to boron, manganese, zinc, copper and uranium. 4. The place where minor elements occur in relation to the physiology of the plant and their function needs investigation. 5. The average position with regard to plant nutrients and how this diverges from the physiological optimum should be studied both as affecting host and parasite. 6. The relation of the incidence of plant disease to the fertilizers used in field experiments should be investigated.

2. PEARSE, H. L. 577.15.04 : 631.535
Experiments with growth controlling substances. I. The reaction of leafless woody cuttings to treatment with root-forming substances.
Ann. Bot., Lond., 1938, 2 : 227-6, bibl. 26.

Treating the basal ends of dormant willow cuttings with lanolin pastes or water solutions containing indolebutyric acid greatly stimulated the formation of roots at the basal ends of the cuttings. When the apical ends were similarly treated root formation was accelerated throughout the length of the cutting and was not confined to the basal portion. Ringing experiments indicated that indolebutyric acid was transported downward in the region of the stem external to the xylem. After treatment of the apical portion of cuttings the maximum response occurred at the most apical node, the number of roots formed gradually decreasing from the apex to the base. When the portion of the base of the cuttings which had been treated was removed, the effect of the treatment was eliminated. When the treated portion of the base was cut off a further treatment with indolebutyric acid again caused a response. These results suggest that in these experiments indolebutyric acid itself was the active agent concerned in promoting root formation, and was itself used up or chemically changed in the process. [Author's summary.]

3. FISCHNICH, O. 577.15.04
Wirkstoffe und Wurzelbildung. (Growth stimulants and root formation.)
Angew. Bot., 1937, 19 : 522-30, bibl. 18.

The author describes briefly the methods of application of a number of growth stimulants which have been tried in recent years and the reactions of the plants to them. The effect of outside factors upon root formation and in particular that of light is also discussed. The statements made here are based on the literature cited and on the author's own experiments. Work with vines and coffee has already produced positive results. The author considers that scarcely any plant variety absolutely refuses to form adventitious roots under such treatment. Hence work on growth stimulants should be very valuable.

4. VEH, R. VON. 577.15.04 : 634.1/2
 Entwicklung und Stimulation. (Development and stimulation.)

Züchter, 1937, 9 : 288-98 and 311-9, bibl. 35.

The author considers at length the problem of the growth impulse in plants and seeds and its connexion with growth stimulants, internal and external. He reviews previous work on the subject and then describes his own experiments conducted in 1936 at the Kaiser Wilhelm Institute at Müncheberg, Mark, with apple, pear, quince, cherry, apricot, peach, plum, mirabelle and gourd seeds. These seeds were germinated on damp filter paper and, in a more satisfactory way, on galvanized wire netting submitted to a continuous fine mist of water. The apparatus is described. The trials, results of which are given in detail, indicate that 1. In all the various seeds embryos possessed a readiness to develop. (The author makes a distinction between "readiness" (Entwicklungsbereitschaft) and "induced ability to develop" (Entwicklungs-fähigkeit), the latter quality depending (a) on development not being hindered and (b) on environmental conditions being suitable for germination). 2. In no case was the development of embryos hindered from within. The author comes to the conclusion that germination, ontogenetic development of the plant and stimulation are not a mere problem of growth-stimulants.

5. AMLONG, H. U., AND NAUNDORF, G. 577.15.04
 Über einige praktische Anwendungen der pflanzlichen Streckungswuchsstoffe.
 (A few examples of the practical application of growth stimulants to plants.)

Forschungsdienst, 1937, 4 : 417-28, bibl. 8.

A tabulated and illustrated report of trials made in 1933, 1934 and 1936 on 13 different plant varieties, 100 seeds being used in each case. Reference is first made to β indolylacetic acid tests conducted by Davies, Atkins and Hudson (in 1937) with the seeds of *Avena sativa*, *Lepidium sativum* and *Brassica alba*, which had negative results. The authors sum up the more important results of their own experiments, which are here fully described, as follows:—1. The viability of seeds, which for some reason or other only germinate with difficulty, can be remarkably improved by soaking the seeds prior to sowing for 24 hours in 0.01-0.001N solution of heteroauxin (β indolylacetic acid). 2. After this treatment seeds not only germinate better but also develop into bigger and stronger plants. In the case of radishes an increase of 98% of root weight resulted from the treatment of the seeds in 0.001N solution, and sugar beet seeds soaked in 0.01-0.001N solution of heteroauxin similarly produced better plants with larger leaves. 3. Fine spraying of plants with β indolylacetic acid results in a stronger development of vegetative shoots and blossoms. But this only can be achieved if fairly concentrated solution is used (0.01N) and by prolonged treatment. 4. Green and woody cuttings of vine, *Malus paradisica* and willow, soaked for 24 hours in 0.001N heteroauxin solution produce roots earlier and in greater number than the controls.

6. SNOW, R. 577.15.04
 On the nature of correlative inhibition.
 New Phytol., 1937, 36 : 283-300, bibl. 19.

The main theories as to the manner in which the auxin produced by the apices of growing shoots brings about the inhibition of the lateral buds below are critically discussed. The author supports the theory of Loeb (1924)* and Laibach (1933)† that the auxin travelling down a stem promotes its growth, and the growth of the stem then somehow inhibits the lateral buds secondarily; but he suggests that the primary process promoted by the auxin in the stem need not always be actual growth. Evidence is given to show that whereas auxin travels mainly only in a morphologically downward direction, the inhibiting influence can travel in both directions, and the suggestion is made that in a stem, down which auxin is travelling, the growth promoting effect of the auxin overrides the secondary inhibiting influence; but as not much

* Regeneration from a physico-chemical viewpoint. New York.

† Wuchsstoffversuche mit lebenden Orchideenpollinien. Ber. dtsch. bot. Ges., 51 : 336.

auxin travels in the morphologically upward direction into lateral buds or shoots, whereas the inhibiting influence does, in the absence of auxin it stops the growth of these laterals. Attempts to extract from inhibited shoots some substance to which inhibition might be due have so far been unsuccessful.

H.L.P.

7. WENT, F. W. 577.15.04 : 635.656 : 631.541.1

Transplantation experiments with peas.

Amer. J. Bot., 1938, 25 : 44-55, bibl. 8.

Experiments are described in which pea shoots 4 cm. long were grafted on to root systems (with attached cotyledons) of the same or of other varieties of pea. The seedlings were grown throughout in a dark room maintained at 24° C., and 85% humidity. The stems and leaves of the scions did not resume growth until actual union of the grafted peas through junction of the tissues by regenerated vascular bundles had occurred. When scion and rootstock were of the same variety, growth was renewed at approximately the initial rate after union was completed. When different pea varieties were used either as rootstock or as scion, then the growth of the grafted tops depended, (1) upon the specific reactivity of the top, and (2) upon the supply of certain growth factors, the calines, from the base. Stem growth, leaf growth, stipule growth and petiole growth were all affected differently by the varieties used as rootstock, so the author concludes that each of these processes is affected by a different factor or set of factors. These factors, which come from the base and move through living tissues only, have provisionally been placed together in a new category of plant hormones, the calines. The tentative suggestion is made that the dwarfing effects of certain *Citrus* and *Pyrus* rootstocks on the grafted scions may be due to similar special growth factors which move from stock to scion.

H.L.P.

8. KERSTING, F. 631.811.4

Die Bedeutung des Kalziums für die höhere Pflanze. (**The part calcium plays in the life of plants.**)

Forschungsdienst, 1938, 5 : 48-57, bibl. 2 pp.

A review of the literature with a description of how calcium affects the development of plants.

9. NIKLEWSKI, B., AND WOJIECHOWSKI, J. 631.87 : 581.14

Über den Einfluss der wasserlöslichen Humusstoffe auf die Entwicklung einiger Kulturpflanzen. (**The influence of water-soluble humus substances on the development of certain cultivated plants.**)

Bodenkunde Pfl. Ernähr., 1937, 4 (49) : 294-327., bibl. 23.

A review of literature cited and descriptions of experiments conducted by the Institute of Plant Physiology and Agricultural Chemistry of the University of Posen, concluded in spring 1937. The report is amplified with tables and illustrations. The following notes are taken from the authors' summary:—Very small quantities of humus preparations obtained from peat by means of alkalis or of sodium fluoride stimulated root growth in different plants, both in water and sand cultures. The stimulating effect was observed to be particularly strong in solutions containing mineral nutrients, and here not only were shoots and leaves increased but also the chlorophyll content in the leaves. The reasons for such stimulation were not found, but the suggestion is made that it may be due to a greater plasma-permeability for the minerals resulting from the presence of humus substances. Farmyard manure contained 1-2.5% (dry weight) of soluble humus substances. Farmyard manure, prepared by the hot fermentation, Krantz method was particularly rich in these substances. They are said to have a particularly strong stimulating effect on plants. Their stimulating effect does not however last long owing to their changing from the "sol" to the "gel" state. "Ca" ions in particular tended to bring about this undesirable change. Compost mixtures containing substantial quantities of soluble humus substances (0.1%) also had a stimulating effect on plants. Field experiments with cereals and sugar beets showed that the stimulating effect of 3 different compost mixtures was directly proportional to their content of soluble humus substances.

10. ISGUR, B., AND FELLERS, C. R. 577.16 : 631.8
A preliminary study of the relationship between vitamin C content and increased growth resulting from fertilizer applications.
J. Amer. Soc. Agron., 1937, 29 : 890-3, bibl. 4.
 The experimental material used by the authors consisted of New Zealand spinach (*Beta vulgaris*) and Swiss chard (*Tetragonia expansa*). From their results and those of other workers with other material, fertilizer treatments would appear to affect vitamin C formation differently in different species. No evidence can be produced, however, to show that the use of a properly balanced fertilizer decreases the ascorbic acid content of plants.

11. BOGUSLAWSKI, E. VON. 631.432 : 631.55
 Wasserhaushalt und Ertragsbildung der Pflanze in Abhängigkeit von der Wasserversorgung und dem Wasserhaushalt des Standortes. (The use of water and productivity in plants in relation to the supply and availability of water in their place of growth.)
Forschungsdienst, 1937, 4 : 370-81, bibl. 114.
 A concise and useful review of the extensive literature on the subject.

12. TORMAU, O. 581.084.1 : 581.11 + 581.14
 Ein neues Wasserkulturgefass. (A new vessel for use in water culture trials.)
Forschungsdienst, 1938, 5 : 143-4.
 A description of a new apparatus permitting constant, separate measurements of plant transpiration and increase in plant material. The apparatus is shown in diagram and details are given of dimensions, materials and method of use.

13. THOMAS, W. 581.192 : 631.8
Foliar diagnosis : principles and practice.
Plant Physiol., 1937, 12 : 571-99, bibl. 42.
 An attempt to express in mathematical form the relationships existing between the amounts of the various mineral constituents of leaves and to use this as a basis for diagnosing manurial requirements. W.A.R.

14. GRANDFIELD, C. O., AND ZINC, F. J. 581.084.1
A humidity and temperature control cabinet for growing plants.
J. agric. Res., 1937, 54 : 503-8, bibl. 7.
 Details of construction are shown by a photograph of the chamber and plans of its construction. It consists of a double chamber constructed entirely of window glass except for floor and framework, the maximum light is thereby obtained and light conditions are as normal as possible. Relative humidity is controlled by an aqueous solution of sulphuric acid in the inner chamber. Temperature is controlled by radiation through the glass into the inner chamber. How the cabinet can be used for soil moisture control studies is also shown.

15. ROBERTS, R. H., KRAUS, J. E., AND LIVINGSTON, N. 581.12 + 581.13
Carbon dioxide exchange rhythm and fruitfulness in plants of different reproductive habits.
J. agric. Res., 1937, 54 : 319-43, bibl. 7.
 Among the plants forming the experimental material were apple, potato, spinach, tobacco, geranium and several other ornamentals. Results which are tabulated and graphed are summarized by the authors as follows:—"The internal condition of the plant resulting from its past environment has a marked effect upon its CO₂ utilization. The form of the CO₂ exchange curves is apparently affected in part by stomatal movement; for example, a reduction in CO₂ intake by apple leaves in the early afternoon followed stomatal closing. Apparently other photochemical effects than photosynthesis may be responsible for the phenomena of photoperiodism. At least photoperiod responses are secured under light conditions which do not

give CO₂ intake. The irregular form of the CO₂ exchange curve which accompanies the reproductive stage may be directly correlated with anatomical characters, and so related to the fruiting condition. The fact that the type of the CO₂ intake and respiration curves is correlated with the reproductive state of the plant is taken to be an indication that a common physiological condition is present in all of the reproductive plants under observation."

16. HOMAN, C. 613.167.4 + 612.22.02

Effects of ionized air and ozone on plants.

Plant Physiol., 1937, 12 : 957-78, bibl. 29.

The author claims to have disproved the statements of certain previous writers that ionization of the air promotes plant growth and points out how their mistakes arose. Plants grown by the author in highly ionized air, 1,100,000,000 ions to 21,000,000 per c.c., showed no changes in appearance or dry weight whether the treatment was intermittent or continuous or in bright or dim light. Ozone in a concentration of 1 in 1,000,000 to 1 in 8,000,000 of air produced necrotic spots and final desiccation of the leaf; at lower concentration (but detectable by odour) no stimulation of growth or other effects on appearance; at very high concentrations, 1 in 100,000, prompt wilting and bleaching, the older leaves succumbing first (*Phaseolus vulgaris*). Ripening in tomato and banana was not accelerated by O₃ while high concentrations (higher than for leaves) produced spotting. A method is developed that would be applicable to the study of the effects of different gases on plants under controlled conditions.

TREE FRUITS, DECIDUOUS.

General.

17. WETZEL, A. 634.31

Obstbau in Zahlen. (Fruit growing statistics.)

Ernähr. Pfl., 1937, 33 : 172-4.

Statistics showing the number of fruit trees and the production of apples, pears, plums, cherries, peaches and apricots in Germany and other fruit growing countries. The data are taken from *Landw. Jahrbücher*, Vol. 78, p. 497, and are yearly averages recorded in the case of most countries for a different period of years, 1930 being the latest year considered except in the case of Germany.

Varieties and breeding.

18. VAN CAUWENBERGHE, E. 634.23

Enquête sur les variétés de cerises cultivées dans la province de Liège.

(Enquiry on the cherry varieties grown in the province of Liège.)

Fruit belge, 1937, 5 : 75-108, bibl. 8.

The enquiry was undertaken to determine the identity of the varieties of cherry commonly grown in Liège. The opening pages describe methods of cultivation in common use. The remainder of the report is taken up with a close description of each variety (tree, branch, leaf and fruit and any special notes), a list of its synonyms and misnomers. Nineteen varieties are so treated and 7 varieties of secondary importance are more briefly mentioned.

19. MAGNESS, J. R. 634.11-1.523

Progress in apple improvement.

Yearb. U.S. Dep. Agric. 1937, pp. 575-614. bibl. 17.

Very few of the apples which are now grown successfully for market originated as the result of systematic hybridization. Only very little systematic apple breeding work was done in the U.S.A. prior to 1895. In most parts of the U.S.A. it is reckoned that some 25 years are needed to evaluate accurately the progeny of any apple cross. Another 5 to 15 years must then elapse before commercial orchards come into full bearing. The aims of breeding in the U.S.A. have varied according to the district and include the following:—greater winter hardiness, later

blooming to avoid danger from spring frost, greater disease resistance especially to scab, blotch, bitter rot, fireblight and apple cedar rust, less susceptibility to spray injury, richer flavour, good keeping qualities and combinations of these qualities. Bud selection has proved useful, but hybridization offers greater scope. The technique of hybridization work is briefly described with illustrations. The significance of chromosome numbers, the possibility of breeding for triploid varieties, and the dominance or recessive nature of certain growth characters are discussed. A brief account is given of the apple breeding work at 12 State experiment stations and at 2 centres directed by the U.S. Department of Agriculture. Notes are included on Canadian work at Ottawa and other centres, and in an appendix the main points of European work on apple breeding in England, Czechoslovakia, Germany, Sweden and U.S.S.R. are noted. Finally in tabular form details are given with regard to apples grown in the U.S.A. as follows:—origin of important varieties; the place of origin, parentage, date of introduction and characteristics of varieties developed in breeding work at U.S. stations; apple crosses of which 5 trees or more have fruited and the number of promising seedlings resulting in breeding work at U.S. stations; and the stations and names, with dates of initiation of work, of past and present workers concerned in apple breeding in the U.S.A.

20. MAGNESS, J. R.

634.13-1.523

Progress in pear improvement.*Yearb. U.S. Dep. Agric. 1937*, pp. 615-30, bibl. 9.

The bane of pear growing in the United States is fireblight (*B. amylovorus*) which thrives in the warm, humid summers experienced over large areas in the States. The greatest development of pear growing has centred in the fairly warm, dry valleys of the three Pacific Coast States. The highest quality varieties, all *Pyrus communis*, such as Bartlett, Anjou, Bosc and Winter Nelis are direct European importations. The chief objective of pear breeding is to secure resistance to fireblight coupled with satisfactory dessert quality. At present varieties possessing fair resistance, primarily *Pyrus communis* \times *P. serotina* hybrids, are all inferior to the better but blight susceptible *P. communis* varieties. A second localized object is additional hardiness. Rootstocks are also needed combining blight resistance with satisfactory hardiness, congeniality to scions and adaptation to environment. Many *Pyrus* species are available for breeding purposes, and of them the following would appear to offer the greatest promise of achieving the aims envisaged:—*P. communis*, to which the best European varieties belong; *P. nivalis* Jacq., the snow pear, susceptible to blight but useful for developing perry types; *P. serotina*, the sand pear, showing considerable resistance to blight; *P. ussuriensis* Maxim, the Ussurian pear, showing great hardiness and blight resistance; *P. calleryana* Decne., the Callery pear, very blight resistant but not hardy; and *P. betulaeifolia* Bunge, the birchleaf pear, some strains blight resistant, easily propagated from root cuttings and so offering promise as a rootstock. Notes are included of pear breeding work at the following centres:—The experiment stations of California, Georgia, Maryland, Michigan, Minnesota, New York (Geneva), Oregon (the Southern Oregon Branch Exp. Sta. Reimer's work being the foundation), Tennessee, and of the U.S.D.A. at Arlington, Va. Lists are given of leading pear varieties, of workers on pear breeding in U.S.A. and of pear material found to be of particular interest from a breeding point of view at different centres in the States.

21. CULLINAN, F. P.

631.523 : 634.25 + 634.22 + 634.23 + 634.21

Improvement of stone fruits.*Yearb. U.S. Dep. Agric. 1937*, pp. 665-748, bibl. 34.

A discussion of the botany and methods of breeding of the stone fruits in general precedes that of particular fruits.

Peaches, pp. 673-702. An account is given of the peach breeding carried out during the last 30-40 years both by private persons and public institutions in the United States, Canada, England, New South Wales and Morocco. Among the varying objectives in different parts of the United States the following may be noted:—a combination of the adaptability to a wide range of soils and climates and the shipping qualities of the Elberta with higher fruit quality and

greater resistance to low winter temperatures ; a hardy commercial variety for the colder peach growing areas ; a combination of the very high quality of the Crawford type with hardiness and productiveness of other varieties ; a peach which will not be subject to the delayed foliation — in which connexion crosses with the St. Helena and Transvaal types offer some promise of success ; rootstocks less susceptible to cold injury and root disease ; production of good canning types lacking such objectionable traits as red colour in the flesh, pit splitting, gumming and susceptibility to mildew. A section is devoted to such genetic factors as the inheritance of flesh characters, of nectaries, of tree habit and of the particular characters found to be transmitted by particular varieties. The location of important peach breeding investigations with names of workers in California, Iowa, Michigan, N. Jersey, U.S. Dep. Agric. and Ontario, Canada, are set out and the actual material available at different centres is listed.

Plums, pp. 703-23. The chief species grown in the States are :—(1) *Prunus domestica*, the European plum, with a large range of delicious plums, which are, however, not well adapted to regions with hot dry summers or dry cold winters ; (2) *P. insititia*, the damson ; (3) *P. salicina*, the Japanese plum, which shows itself very adaptable for all except the very coldest U.S. climates. It is hardy and productive but of not such good flavour as *domestica* ; (4) *P. americana* and other types of native plum. The main objective in breeding is the production of higher quality varieties suitable for the various fruit regions. None of the high-quality *domesticas* can be grown satisfactorily south of Virginia or in the south west or south central U.S. Unfortunately the *americanas* and *domesticas* have different chromosome numbers and crosses so far have not yielded viable seedlings. Further study is necessary on artificially increasing desirable mutations. Careful search should be made for desirable bud sports. Results achieved both by private and other breeders are discussed and the genetic and cytological studies of the plum made in England and the States are briefly summarized. Incompatibility due to genetic make-up would appear to cause certain difficulty in plum breeding and the chromosome complement of the more important *Prunus* species is considered. The plum section ends with lists of places, workers, varieties, introductions, hybrids and material available at the more important plum breeding centres in California (3), Iowa, Minnesota, N. York, N. and S. Dakota, Ontario, England and N.S. Wales.

Cherries, pp. 724-37. Both sweet (*Prunus Avium*) and sour (*P. Cerasus*) cherry varieties are somewhat susceptible to winter injury. Moreover, in the hot dry summers of the south the sour cherries do not thrive and in the wetter regions they are very susceptible to brown rot. The chief commercial production of sour cherries is limited therefore to districts along the Great Lakes in the East and of sweet cherries to the Pacific and Intermountain States of the West. One of the main objectives of breeding is the production of high quality sweet varieties possessed of greater hardiness in tree and blossom characters. Where cherries are now grown in the States there is need for firm-fleshed varieties which do not crack and which will ripen over a long season. At present firm-fleshed, early-ripening cherries of the bigarreau type are wanting. A difficulty in growing, in the Northern Great Plains especially, is the relative tenderness of some of the mahaleb and mazzard stocks used as rootstocks and selection of better stocks needs attention. Cherries are not grown in the south owing to the susceptibility of the present varieties to disease, and here is another field of research for breeders. Very little of the cherry breeding work has been done by private individuals, but it is now in progress at several of the State experiment stations, notably at Davis, Calif. ; Ames, Iowa ; Geneva, N.Y. ; Mandan and Fargo, N. Dak. ; Brookings, S. Dak. ; Logan, Utah ; and in Canada at Vineland, Ont. The cherry material available at Davis and at Geneva is listed.

Apricots, pp. 738-48. The difficulty has so far been with apricots their liability to flower too early in the spring and so to spring frost damage. Hence production has been limited to the Pacific Coast and Intermountain States. The apricot, almost entirely *Prunus armeniaca*, is less rich in species and horticultural varieties suitable for breeding than the other stone fruits. The chief objective in breeding would appear to be the production of later flowering varieties. Better canning, drying and shipping varieties are also wanted. For breeding work in the Eastern States some of the hardy but otherwise inferior U.S.S.R. varieties imported into Iowa and other varieties brought into S. Dakota offer promise. The following institutes are breeding

or studying the production of better apricots:—Calif. A.(gric). E.(xp). S.(ta). at Davis; U.S. Dep. Agric. at Davis and Palo Alto, Calif.; New York A.E.S. Geneva; Dak. A.E.S. at Fargo and Mandan; S. Dak. A.E.S. at Brookings; Utah A.E.S. at Logan; and foreign—Dep. Agric. N.S. Wales at Sydney and the Experimental Laboratory at Ain Taoujdat, Morocco. A list of material and hybrids produced at certain of the above stations is given.

22. RYBIN, V. A. 634.22-1.523
An attempt to produce cultivated plum trees from wild varieties. [Russian.]
Bull. appl. Bot., Leningr., 1935, Ser. A, No. 15, pp. 87-100, bibl. 16.

A study with plums was begun in 1933 at the Shuntuk Branch Station by the Institute of Plant Industry. Natural hybrids of *Prunus spinosa* \times *Prunus divaricata* were found in the Maikop District. Wide distribution as well as morphological varieties of these hybrids suggested that natural hybridization takes place without much difficulty. In the present experiment over 9,000 cross-pollinations were made. 16 hybrid seedlings were obtained, one of which was an amphiploid plant with 48 chromosomes. This polyploid hybrid was larger than the other plants, very closely resembled varietal plum trees, and was found to be of the greatest interest for further investigations on the origin of plums. The report is tabulated.

23. ISAEV, S. I. 631.523 : 634.1/7
Selection work of the experiment network in Mitchurin's Research Institute.
[Russian.]

Sci. Fruitgrowing, Mitchurinsk, 1937, No. 3, pp. 19-29.

A review of hybrid production by the Mitchurin Institute. In 1936 the selection department of the Institute distributed for hybridization of fruit and berries 82 pollen varieties in quantities sufficient for pollinating 250,000 flowers. In 1937 the distribution is to be carried out on a yet larger scale. The author draws attention to new hybrid varieties of prune, vine, black-currant, gooseberry, strawberry, pear, apple and cherry. In some cases it is mentioned what selections were made. The production of hybrids is discussed for three separate areas:—1. the Eastern and the Northern Districts, 2. the Middle Zone, and 3. the Southern Zone. The work of every station in these zones is described briefly. It is considered essential that the best varieties obtained by breeding should be propagated at once for introduction into commercial use on a larger scale than is at present the case.

24. SCHMIDT, M. 631.523 : 634.1 + 634.2
Aufgaben und Stand der Züchtung von Kern- und Steinobstsorten. (The objects and present position of the pome and stone fruit breeder.)
Forschungsdienst, 1938, 5 : 27-48, bibl. 211.

This paper was especially written for a section of the fruitgrowers' union at the Kaiser Wilhelm Research Institute, at Müncheberg. The author reviews the more recent work on fruit breeding. The general principles and methods on which successful fruit breeding is based and the difficulties, peculiarities and aims involved, with special reference to German requirements, in breeding apples, pears, quince, cherries, plums, apricots, peaches and almonds are discussed. Attention is drawn to the long bibliography of which ample use is made.

25. RYBIN, V. A. 634.22-1.523
Hybrids between the blackthorn (*P. spinosa* L.) and the myrobalan (*P. cerasifera*) and the problem of the origin of the cultivated plum. [Russian, English summary 3 pp.]
Bull. appl. Bot., Leningr., 1936, Ser. II, No. 10, pp. 5-45, bibl. 53.

Investigations of the origin of the cultivated plum led to hybridization trials between blackthorn and myrobalan. These trials were started in spring 1933 at the Shuntuk Branch Station of the U.S.S.R. Institute of Plant Industry and were made with 16 blackthorn and 6 myrobalan trees. 5,919 blackthorn flowers were pollinated with myrobalan pollen and 3,125 myrobalan

flowers with pollen from the blackthorn. 361 ripe fruits were obtained from the cross blackthorn \times myrobalan and 90 fruits from the reverse cross. In spring 1934 the hybrid seeds produced 14 seedlings from the first-mentioned cross and 2 seedlings from the reverse cross. All hybrid seedlings from the blackthorn \times myrobalan cross were triploids ($2n=24$), while one of the seedlings from the reverse cross was a triploid and the other a hexaploid ($2n=48$). All 15 triploid seedlings were morphologically similar to one another, differing chiefly in the vigour of growth and in leaf shape. The hexaploid seedling which arose either by somatic doubling of the chromosome number in the zygote or by fertilization of an unreduced egg cell of the myrobalan by an unreduced pollen grain of the blackthorn—at the present time it is not possible to state which—is distinguished from the triploid seedling by larger and broader leaves and by more vigorous growth. Its leaves are darker in colour and consist of larger cells with larger nuclei and chloroplasts. As to habit, the hexaploid seedling resembles a plum seedling. Since, as the result of chromosome duplication, it must be fertile, this seedling is of the greatest interest.

26. MORETTINI, A. 634.25-1.523
 Ricerche per la creazione di nuovi tipi di peschi mediante l'incrocio. (**Attempts to produce new types of peach by breeding.**)
Ital. agric., 1937, **74** : 617-28, bibl. 12.

In the author's attempts to raise new early peaches showing good consistency and non-clinging qualities he has produced two by crossing Superba with Mayflower and these he describes here. Although they offer certain excellent qualities, which are detailed, they are not entirely satisfactory. The methods which he has adopted for quickly getting fruits from the new hybrids may be of interest. The stones were separated from the ripe fruits, dried in the shade and stratified. In February they were planted in suitable beds or pots, the latter facilitating transplanting, a practice which takes place in July or August and tends to accelerate fruit production. The seedlings are then allowed to grow, the branches not being pruned but being bent over. Fruit may be expected in the second or third year from transplanting. A second method consists of taking dormant buds from the seedling in the year of sowing and working them in August on to 2- or 3-year-old plants already trained. One can thus work a number of hybrid buds on to a single plant. By appropriate bending of the shoots which issue, fruit formation can be accelerated. Finally, if there are no adult plants available for working, the same buds can be worked on to seedling rootstocks in the nursery. If budding is done in August, unbudded adjacent stocks can be pulled out and the shoots formed from the buds suitably bent over at the beginning of the next spring growth with the result that fruit will be obtained the same year.

*Propagation.**

27. KINMAN, C. F. 634.22 : 575.252
 An orange-colored bud sport of the Agen plum.
J. Hered., 1937, **28** : 419-20.

A recent bud sport of the Agen plum is described from U.S.A. The outstanding characters that distinguish the bud sport from the remainder of the tree are the orange colour and large size of fruit, small pits and heavy yield.

28. BURMISTROV, A. 634.22-1.541
 On the rationalization of plum propagation. [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 3, pp. 92-5.

A detailed description of winter grafting on plum seedlings. The experiments were conducted under Mitchurinsk conditions. The grafting was done from 27th February-2nd March in a greenhouse at a temperature of 12-15° C. As compared with the results of summer budding in the nursery from 10th July-15th August, the experience of 1935 and 1936 (in spite of the spring drought in the latter year) indicated that winter grafting gives the best take. All statements are supported by numerous experimental data which are tabulated.

* See also 2-6.

Rootstocks.

29. TIKHONOV, N. N. 634.22-1.541.11

Cerasus japonica Thunb. as rootstock. [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 3, pp. 88-91.

Attempts are being made by the Fruit Department of the Far-Eastern Institute of Agriculture to utilize indigenous material for rootstocks in those districts. This paper shows that no success attended the efforts to produce *Cerasus japonica* Thunb. hybrids by crossing with *Cerasus tomentosa* or European cherry variety. Promising results were obtained in 1935 and 1936 by grafting this rootstock with myrobalan hybrids imported from the U.S.A., as well as by grafting it with hybrids of several plum varieties \times *Cerasus Besseyi*. The information is tabulated. Hybrids of the American plum variety Opata \times *Cerasus japonica* Thunb. are said to be bred successfully in the nursery of the Kharbin experimental field.

30. BEYME, D. 631.541.1 : 634.11 + 634.13

Beiträge zur Physiologie einiger Symbiosegruppen des Kernobstes. (Notes on the physiology of stock scion relationships in pome fruits.)
Kühn Arch., 1937, 42 : 32-58, bibl. 51.

The author reports the observations made by him on a number of what Baur has designated "Symbiosegruppen" namely the normal combination presented by pome fruit trees and their rootstocks. The stocks examined were apple:—Jaune de Metz (No. IX), Doucin Amélioré (No. V), and Ketziner Ideal (No. XVI) and seedlings, and pears:—pear seedlings and Angers quince (Malling A). The apples and pears were commercial English and German varieties. In them, both worked and unworked, the following determinations were made:—monosaccharide content, invert sugar, dry matter, refractometer value, osmotic value and electroconductivity, and the values were compared with reference to the state of the combination, i.e. whether worked on seedling or No. IX, or on other stocks. In spite of the fact that the plants were not obtained from the nursery at the same time the results showed a good measure of uniformity for any given combination at any given age. The respective values found in scions and stocks tended to level up much more in the case of varieties on seedling stocks than in that of varieties on the dwarfing stock, Malling IX, and of pears on quince A. The values in quince A stock, for instance, were hardly affected at all by grafting with a pear variety. From this it is concluded that a considerable degree of incompatibility exists between pear varieties and quince stocks and between apple varieties and some of the vegetatively reproduced stocks. The early flower production in apples on IX and in pears on quince noted in these experiments is found to correspond with and be marked by a high carbohydrate content.

31. CHANG, W. T. 631.541.1 : 634.1/2

Studies in incompatibility between stock and scion, with special reference to certain deciduous fruit trees.

J. Pomol., 1938, 15 : 267-325, bibl. 65.

The author gives an account of the observations made by him at East Malling in the years 1935-7 on a number of combinations of rootstock and scion and of their bearing on the general problem of incompatibility. Previous work on the subject and the results thereof are discussed and compared with the author's data. In all some 86 grafted and 32 budded combinations of scion-stock, stock-scion and stock-stock were studied, all stocks being of clonal origin. The following notes are taken from the author's summary:—With all incompatible combinations, grafted or budded, there were marked symptoms of a low percentage take, premature autumn leaf-coloration and flower bud formation, early defoliation, and dying back of young shoots. The low percentage take was less noticeable on budded than on grafted plants. In all incompatible combinations there was a marked gradual decline of the annual wood growth, usually following an initially vigorous growth at an earlier stage. There was also a gradual decline of new root growth both in number and length. The incompatible combinations started new root growth much later in the spring than the compatible ones. All incompatible combinations showed a mechanically weaker union than the compatible ones. This was indicated by:—(a) bark and wood-fibre discontinuity, (b) heavy accumulation of parenchymatous cells at the

union, (c) reduced strength at the union and clean surface of break. Incompatible combinations had some form of obstruction at the union. This was indicated by:—(a) slower flow of dyes through the union, as shown by dye injections, (b) a much higher resistance to the flow of water, (c) a heavy deposit of starch above the union in November. Some of the physiological functional differences between the scion and its incompatible stock have been studied. It was found that different stock and scion varieties had:—(a) different periods of cambial activity, (b) different periods of callus growth and different regions of callus differentiation, as studied in grafts, (c) difference in the duration of leaf-expansion from the time of bud-break. The combination was most incompatible when a slow leaf-expanding scion was worked on a quick leaf-expanding stock, (d) difference in growth curves, as shown by the weekly measurements of the terminal shoots. It is concluded that a mechanically weak union and the increasing obstruction at the union are the immediate causes of shoot and root decline in an incompatible combination, and that all the physiological functional differences manifested in cambial activity, callus growth, duration of leaf-expansion, and growth curves of the stock and scion varieties may be accounted as important contributory causes of incompatibility among deciduous fruit trees. It is pointed out that all these physiological functional differences in the growth activities of the stock and scion are inherent, and may be somewhat modified under different climatic and environmental conditions.

32. ANON. 631.541.11 : 634.1/2
Kontrolstationen for Grundstammer. (The control station for rootstocks.)

Reprinted from *Ehrvervsfrugtavleren*, 1937, No. 1, 2 pp.

An account from the control station at Kontrolmarken, Aarslev, Denmark, on rootstock control and on questions of nomenclature in apples, pears, plums and quinces which arose in Danish nurseries in 1937.

Rootgrowth.

33. MARANI, M., GOIA, G., AND GERBALDI, C. 634.25-1.536 : 581.144.2
Secondo contribuzione alle ricerche sulla formazione invernale di radici nel
pesco. (A further note on the root growth of peaches in winter.)
Riv. Frutticoltura, 1937, 1 : 185-96.

Another year's work confirms the results obtained previously (*Ibidem*, pp. 3-34, *H.A.*, 1937, 7 : 28). Data are graphed and tabulated and are summarized by the authors as follows:—In these experiments with one year seedling peaches new roots formed and grew from the time of transplanting throughout the winter of 1936-1937 except in the case of a series transplanted on 15 Dec. and examined on 15 Jan., the latter period being one during which the average temperature of the soil at 15 cm. below the surface was 1.31° C. At the end of the trial, on 15 March, 1937, the number of new roots on the early transplanted peaches, i.e. those planted on 15 Oct. and 15 Nov., 1936, was appreciably greater than that of those transplanted on 15 Dec., 15 Jan. and 15 Feb. Not only was the number of roots greater but the roots themselves were considerably longer.

Pollination.

34. VASILYEV, Y. P. 581.162.3 : 634.11 + 634.13
Modified orchard method for selection of pollinators. [Russian, English
summary 1p.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 3, pp. 46-59, bibl. 10.

Basing his remarks on results detailed in the literature cited and on his own studies, the author indicates that pear and apple trees, when lacking nutrients, in the first instance drop those fruits which contain fewer seeds. The seed is said to have a great influence on the formation of fruit flesh. Since the amount of nutrients in the top branches of a tree varies so much, it is impossible to determine the inherent fruitfulness of a tree from the number of fruits eventually borne at harvest time. The time required for the pollination process was found to determine the seed content in fruit. The author suggests that pollination results should be studied in the first stage of ovary development, i.e. before the June drop, and he explains how they should be subsequently corrected.

35. YUDINCOVA, E. A. 634.13 : 581.162.3
Selection of pollinators for Mitchurin's pear varieties. [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 3, pp. 41-5.

The author's experience over 3 years confirms the fact that non-self-pollinating pear varieties (i.e. those with a fruit set of under 4%) cannot produce good crop results, even under 1st class conditions. He, therefore, carried out cross-pollination experiments with 6 Mitchurin and 2 other well-known varieties. The effect of 2 or 3 different pollens was tried on 300-350 blooms each of 20-30-year-old trees. The actual number of trees used in the experiment is not stated. The average results of three years are tabulated. The following notes are taken from the summary:—1. Cross-pollination of all the varieties is possible in spite of annual variation of time of bloom. 2. All the varieties tested proved self-sterile. 3. The best pollinators for varieties raised by Mitchurin are listed.

36. VASILYEV, Y. P. 546.27 : 581.162.3 : 634.11 + 634.13
The importance of boron for the process of fertilization. [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 4, pp. 24-32, bibl. 10.

In 1936 experiments were carried out at the Mitchurin Research Institute with pollens from 6 apple and 5 pear varieties to determine the influence of boracic acid on pollen germinability. The concentration of boron in sugar solutions was varied. The author reaches the following conclusions:—Boron added to sugar solutions increases the germinability of pollen grains and the growth of pollen tubes in apples and pears. The most effective boron solution for fresh pollen is 0.001% and for stored pollen 0.0005%. When determining pollen germinability it is suggested that sugar solutions containing boron should be used in order to approach more closely to natural conditions. The influence of boron on pollen germination and growth of pollen tubes suggests its use in spray form on apple and pear trees just before blossoming in order to obtain better pollination results.

37. MARANI, M., GOIA, G., AND GERBALDI, C. 634.25-1.55 : 581.162.3
Ricerche sulla fertilità della varietà di pesco "Bonvicini". (The problem of fertility in the Bonvicini peach.)
Riv. Frutticoltura, 1937, 1 : 225-33.

The conclusions reached previously (*Ibidem*, pp. 49-58, *H.A.*, 1937, 7 : 842) on the subject of fertility in the Bonvicini peach are confirmed. Further work shows that the variety is self-fertile, but that, as in other peaches also, insects especially bees play a large part in fertilization and set of fruit. No one variety has yet been discovered which has any particular merit for planting as a pollinator with Bonvicini and it is suggested that fertility can best be secured by cultural practices such as long pruning, ringing and the elimination of nitrogenous manuring in young orchards.

38. HEINICKE, A. J., AND CHILDERS, N. F. 634.11 : 581.13
The daily rate of photosynthesis, during the growing season of 1935, of a young apple tree of bearing age.
Mem. Cornell agric. Exp. Sta. 201, 1937, pp. 52, bibl. 25.

The experiments were carried out in an assimilation chamber $7' \times 7' \times 11.5'$, which is illustrated in the paper both by photograph and in diagrammatic form showing air controls, etc., the sides and top being composed of glazed window sash. The temperature was controlled thermostatically so as to fluctuate in the same way as the outside temperature. The routine of taking measurements is described in full. Results are tabulated and graphed. The following notes are taken from the authors' summary of the data obtained in the 1935 season:—Marked fluctuations occurred in the rate of food manufactured from day to day, the factor most often limiting photosynthesis of the full leaf surface being light. The foliage which develops just after the buds have opened is capable of relatively high rates of apparent photosynthesis early in the season. Soon, however, the older basal leaves have to compete for light, water and nutrients with the younger leaves on the ends of the shoots and the latter account for most of the food manufactured

during the greater part of the season. Leaves well exposed to light, when well supplied with water and soil nutrients, can carry on photosynthesis over a wide range of temperatures. The rate of respiration is influenced more by temperature than is the rate of photosynthesis. The varying amounts of carbohydrates needed for respiratory processes at the different temperatures affect the amount of apparent photosynthesis. The higher temperatures which often accompany higher light intensities favour higher rates of respiration and thus tend to counteract the effects of good light. In general the factors that influence photosynthesis also influence transpiration. The closing of the stomates in the afternoon does not reduce the water loss below that found in the morning, when temperature and light are favourable. While variations in CO_2 concentration have some influence in determining the rate of apparent photosynthesis, other factors are more important under natural conditions. The emphasis in this paper is placed on the daily rate of apparent photosynthesis and the external factors which affect it. These daily fluctuations have great influence on the chemistry of the tree. Thus the succession of several clear days or of several cloudy days at critical periods in the seasonal development will appreciably alter the available carbohydrate content. The response of the fruit plant to any soil treatment may be determined very definitely by the number of successive days favourable or unfavourable to photosynthesis. Again the rate of photosynthesis appreciably affects the susceptibility of a tree to the attacks of such pests as aphids, which do more or less damage according to the internal chemical balance of the tree tissues. How rapidly growth and other metabolic processes adjust themselves to the internal chemical environment of a plant is not known. In an attempt to evaluate the effects of all the environmental factors influencing metabolism a knowledge of the daily fluctuations in apparent photosynthesis is essential.

39. GREENE, L. 634.11-1.542.24-1.55
Ringing and fruit setting as related to nitrogen and carbohydrate content of
Grimes Golden apples.

J. agric. Res., 1937, 54 : 863-75, bibl. 13.
 In 1931 at Lafayette, Indiana, some 100 branches were ringed just prior to blossom opening on 8-year-old Grimes Golden apple trees. Other branches were ringed or scored, using the same cuts as in ringing but leaving the bark, up to 2 weeks after blossoming. Similar branches were used as checks. The chemical composition of the spurs was determined and the fruit set noted. The author summarizes as follows:—"Nutritional factors accompanying the setting of fruits on blossoming spurs of young vigorous Grimes Golden apple trees included a high level of carbohydrate synthesis and storage, and a relatively high level of available nitrogen. Early ringing of branches on young vigorous trees doubled, or more than doubled, the percentage of blossoming spurs that set fruit in 1929 and 1931. These rings healed over rapidly during the active growing season. Spurs on these ringed branches were higher in sugar and starch content than were spurs on non-ringed branches. When a large percentage of spurs on a branch blossomed, a relatively small percentage of such spurs set fruit."

40. SMOCK, R. M. 634.16 : 581.145.1/2
Morphology of the flower and fruit of the loquat.
Hilgardia 1937, 10 : 615-26, bibl. 5

The development of the floral organs and of the fruit of the loquat (*Eriobotrya japonica*) is described in detail.

41. GARDNER, V. R. 634.23-1.547.6
Factors influencing the ripening season of sour cherries.
Agrie. Rec. 1927, 55: 521-22, bibl. 12.

J. agric. Res., 1934, 55: 521-32, bibl. 13.
Harvesting records of each of 194 Montmorency cherry trees for 1931 to 1934 at one place and of each of 149 Montmorency trees at a second place formed the basis of observations made on factors influencing ripening in sour cherries. These together with data on Early Richmond trees were considered in conjunction with information available on cultural practice, temperature, and other environmental factors. The following notes are taken from the author's summary:—

In Western Michigan 3 or 4 weeks difference is sometimes found in ripening season of the same varieties in orchards 25-200 miles apart. Yearly variation in any orchard amounts to 2 or 3 weeks. Growing season temperature is a major factor, ripening being delayed by relatively low temperatures. Variation in time of ripening in any one orchard is due to size of crop, relative amount of foliage, large crops and limited foliage tending to delay maturity and cause uneven ripening. Contrary to general opinion the liberal use of nitrogenous fertilizers (coupled with suitable pruning) did not tend to delayed and uneven maturity. The use of nitrogenous fertilizers, spraying to prevent fungal attack and the removal by pruning of small interior limbs all tend to establish a proper balance between crop and growth and so earlier and more even maturity of fruit. Bud sports causing late- or early-maturing strains occur but are of secondary importance.

Soils.

42. PEECH, M., AND BOYNTON, D. 634.1/2-1.432
Soils in relation to fruitgrowing in New York. X. Susceptibility of various New York orchard soils to reduction upon water-logging.
Bull. Cornell agric. Exp. Sta. 667, 1937, pp. 20, bibl. 7.

Measurement of the oxidation-reduction potential of the soil, described in Part IV of this series (see *H.A.*, 1934, 4 : 508) as a promising index of the subsoil drainage conditions, is found not to fulfil these expectations, because not all soils are equally susceptible to reduction on water-logging. Manganese concretions, which are usually present, produce an inherent error in the method used. Well drained types of subsoil were as susceptible to reduction upon water-logging as were poorly drained types. In general, subsoils of light texture, which had wider C : N ratios, were more susceptible to reduction than were heavy subsoils, which had narrower C : N ratios.

W.S.R.

43. CUMMINGS, R. W. 634.1/2-1.417
Soils in relation to fruitgrowing in New York. XI. The organic matter content of New York orchard soils in relation to orchard performance.

Bull. Cornell agric. Exp. Sta. 672, 1937, pp. 26, bibl. 30.

Carbon content of 96 apple orchard surface soils and 31 subsoils was determined, and organic matter was calculated by multiplying carbon content by 1.724. Nitrogen content was determined on these and 65 additional surface soils. Carbon content ranged from 0.75 to 3.95% in surface soils, and 0.03 to 1.35% in subsoils. Carbon-nitrogen ratio was fairly constant, however, averaging 12.74 ± 0.08 in surface soils, and 8.25 ± 1.38 in subsoils. There was no significant correlation between organic matter content of soil and yield and vigour data available. It is concluded that determination of total organic carbon, nitrogen or organic matter content of surface soil in itself has little or no prediction value as to the behaviour of apple trees on that soil. (Yield and vigour data were obtained by the "survey" method, and apparently neither age, variety, rootstock, manurial, nor management factors were necessarily constant, hence these data can only be considered as a very rough indication.—Abstractor.) The rôle of organic matter is discussed, and the author concludes that it is of more direct importance to annual crops than to fruit trees.

W.S.R.

Manuring and cultural practice.

44. PUČNIK, K. 631.8 : 634.22
Die Kultur und Düngung der Pflaumenbäume in Jugoslawien. (The cultivation and manuring of plum trees in Yugoslavia.)
Ernähr. Pfl., 1937, 33 : 43-5.

In 1933-6 trials were made with fertilizers in the plum orchards near Brčko, Yugoslavia. The sandy and clayey soil on which these trials were made was acid (pH 4.7-5.7) and poor in lime. Every year the fertilizers were spread in November and then ploughed in. Fertilizers used were NPK—NP—and control. (It is not clear whether farmyard manure was used or not.—Ed.) The most and the best quality plums came from the plots where the trees had been given—in addition to an ample supply of lime—1.25 kg. of 40% potash salts, 0.75 kg. superphosphate (16%) and 0.75 kg. calcium cyanamide (16%) per tree.

45. RIGG, T., AND CHITTENDEN, E. 634.11-1.8
Influence of manurial treatment on yield and storage quality of Cox's Orange variety of apples.
Orchard. N.Z., 1937, 10 : 272-4.

A brief account is given of a nine-year experiment with 30 trees of Cox's Orange Pippins on poor Moutere Hills soil in New Zealand. The trees were divided into 2 plots and the fertilizers given as follows each year :—plot 1, 4 lb. superphosphate, 1 lb. potassium nitrate, 1 lb. ammonium sulphate ; plot 2 as in 1 but 3 lb. ammonium sulphate instead of 1 lb. Yields and storage qualities were carefully noted. Results are tabulated and show the great importance of the use of liberal nitrogenous manuring in conjunction with both phosphates and potash in maintaining adequate tree growth and fruit yield. In view of the somewhat high fungal rot and internal breakdown occurring in fruit from plot 2 it is, however, suggested that 2 lb. of ammonium sulphate would probably have been preferable to 3 lb.

46. ASSEYEV, G. D. 634.11-1.548
Artificial rain in Crimean orchards. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 1, pp. 52-3.

Trials of overhead watering were made at the Khan Ali State Fruit Farm with 30- to 35-year-old apple trees, number of trees not stated. This type of irrigation was found to produce higher yields of better quality fruit than the normal method of basin irrigation. It is also said to be more economical of water.

47. DOTTI, F. 631.542 : 634.25 + 634.11
La potatura di produzione. (Pruning bearing fruit trees.)
Riv. Frutticoltura, 1937, 1 : 235-44.

The author considers the general principles which should guide the pruner and describes in some detail how they are applicable to deciduous fruit pruning in Northern Italy with particular reference to peach and apple trees.

48. ATKINSON, J. D. 632.953 : 634.11
Wound dressing for fruit trees.
N.Z.J. Sci. Tech., 1937, 19 : 313-6, bibl. 2.

Observations on wound dressings in New Zealand in 1935 and 1936 on Sturmer and Dougherty apples 25-30 years old are summarized. *Coal tar* caused definite bark injury extending sometimes beyond the area actually covered. A little callus had developed on some of the wounds. *Creosote*. Extensive damage more serious than that of tar resulted. There was no callusing. *Bitumistic paint* "*Colasmix*". A slight tendency to lift but usually the cover remained pliable and complete. The bark was undamaged and callusing normal. *White lead paint*. A pronounced tendency to crack and flake off. Slight bark damage but less than with coal tar. A small amount of callus was visible on some of the cuts. *Chavostelon's formula* (equal parts 6% aqueous solution of copper sulphate and 6% aqueous solution of potassium bichromate) caused extensive bark injury similar to creosote damage. No callus formed. *Untreated wounds*. The bark died back a short distance from the edge of the cuts and a small amount of callus tissue formed. The conclusion is reached that the bitumistic paint is a cheap and efficient wound covering that may be used with safety.

49. THOMAS, P. H. 632.953 : 634.1/2-2.4
Treatment of tree wounds.
Tasm. J. Agric., 1937, 8 : 180-4.

In view of the prevalence in Tasmanian orchards of *Polystictus versicolor* various treatments for clean and diseased wounds have been tested. A plot at Kettering was treated as follows at the end of the dormant season in August, 1935 :—(1) Non-infected pruning wounds were coated when dry with bitumen emulsion, (2) limbs with wounds slightly infected were cut back below

the infected area and treated with glycerine-mercuric compound and subsequently coated with bitumen emulsion, (3) seriously infected wounds, where the fungus had extended right into the main limbs or trunk and cutting back into healthy wood was not possible, were treated twice at an interval of 7 days with glycerine-mercuric compound. In November, 1937, an inspection showed that in only one case (in class 3 above) had the disease made any progress, although in untreated sections serious "dieback" was present. In no instance had the fungus developed on non-infected (class 1) limbs. It was noted that when terminal wounds on healthy limbs were treated with bitumen, there was an inclination to exude sap forming a blister. This could be released by pressure. The fungal development was entirely arrested by the glycerine-mercuric treatment. The ingredients of this are as follows:—glycerine 3 quarts, water 1 quart, cyanide of mercury $\frac{1}{4}$ oz., bichloride of mercury $\frac{1}{4}$ oz. It is prepared by combining the water and glycerine and heating to 170° F. In this the cyanide is first dissolved and then the bichloride. It has a corrosive effect on metal and must therefore be stored in an earthenware or glass container. It is a deadly poison. Where wounds are infected, the wound should be cleaned, rough surfaces smoothed and all possible diseased wood and bark removed with a chisel. The exposed surfaces are thoroughly painted. Two applications at intervals of 21 days have proved successful in controlling the worst cases.

SMALL FRUITS, VINES, NUTS.

50. Darrow, G. M., and Yerkes, G. E. 631.523 : 634.7 + 635.9
Some unusual opportunities in plant breeding.

Yearb. U.S. Dep. Agric. 1937, pp. 545-58, bibl. 7.

Brief discussions are given of the following plants which would appear to offer good material for the plant breeder's skill. The actinidiias (*Actinidia arguta* and *A. chinensis*), known also as Chinese or Japanese gooseberries and as sheep peaches, are climbing shrubs. *A. arguta* is hardy in New England, and *A. chinensis* is hardy as far north as Washington, though the growing season there is not sufficiently long to allow the fruits to mature. They have received attention also at the Michurin Institute, U.S.S.R. They are readily propagated by soft- and hard-wood cuttings and by layering. The need is for varieties which will be regularly and not merely spasmodically productive. The American cranberry bush or pembina (*Viburnum trilobum* Marsh) is another promising plant. Its use is for jelly making. Selections at East Lee, Mass., indicate the superiority in the acid, pectin and jelly tests of three varieties, Wentworth, Hahs and Andrews. These may be propagated by soft- and hard-wood cuttings and by layering. Many of the northern State experiment stations are co-operating with the U.S. Dep. Agric. in testing this fruit, notably Maine, New Hampshire, Massachusetts, New York, Wisconsin, Minnesota, North Dakota, Montana and Idaho. The characters of many other species of *Viburnum* are briefly noted and should encourage breeding not only for fruit but also for ornamental characters. Goumi is the name applied in Japan to several ornamental *Elaeagnus* species. *E. multiflora* Thunb. produces good, tart fruit and one or two other species also produce fruits which might be utilized. So far, however, the plants have been grown haphazard from seed, and are extremely variable in amount, size and character of fruit. The plants are very hardy and drought resistant and it is thought that selection and crosses of such species as *E. multiflora*, *ovata*, *umbellata* and *pungens* should give good results. The oriental quinces, (*Chaenomeles lagenaria* Koidz. (*Cydonia japonica* Pers.)) and others, are worth attention. The fruit is valuable for its acidity and pectin content and in some varieties for its persistent perfume. Great promise of usefulness in the preserving industry is offered by selection and breeding, the immediate aim being larger and self-fertile fruits, more open growth of plant and elimination of thorns. The Chinese, Manchu or Nanking Cherry (*Prunus tomentosa* Thunb.) has recently attracted attention to its fruit, which ripens with the last of the strawberries. The fruit is said to have a range in flavour and texture from the sweet to the sour cherry with a peculiarly attractive tang. The fruit is about the size of the European wild cherry. The foliage is resistant

to the common cherry leaf troubles. The plants appear to show considerable drought resistance but to be susceptible to spring frost and brown rot infection. The chief need is the introduction or discovery of late flowering and brown rot resistant seedlings. A cross with the western sand cherry (*Prunus Besseyi* Bailey) has resulted in hybrids which flower later and so are less susceptible to cold injury. Crosses have also been made with Napoleon, Montmorency and other cherry varieties. Other promising dwarf shrubs are *Prunus glandulosa*, *P. triloba*, etc.

51. SHUBERT, N. 634.7
***Actinidia kolomicta* as a source of vitamin C.** [Russian.]
Fruits and Vegetables, Moscow, 1936, No. 5, pp. 34-6.
 A brief description of actinidia varieties, some of which were bred by Mitchurin. The chemical biological analysis made in 1935 showed that actinidiias were rich in vitamin C. *Actinidia kolomicta* was found to contain 13 times as much as lemon juice (reckoning the latter content at 0.07%), while the vitamin C content of the leaves of this variety and of the berries of *Actinidia arguta* was equal to that of lemon juice. The hot flavour of the berries suggested that they contained the poison saponin, but in analyses made by the Moscow chemical, pharmaceutical Institute, no $C_{22}H_{52}O_{17}$ was found in the juice extraction of the berries and leaves.

52. DARROW, G. M. 634.71-1.523
Blackberry and raspberry improvement.
Yearb. U.S. Dep. Agric. 1937, pp. 496-533, bibl. 57.

The history of the origin of the main commercial varieties of blackberries and dewberries is given briefly. Of the varieties mentioned the loganberry, Youngberry, Evergreen, Himalaya, Eldorado and Lucretia are the most widely grown at present and the Boysenberry and Brainerd are promising new kinds. The American wild blackberries are classified by cane characters and good illustrations are given of the forms of prickles occurring on twelve species. A short account of the work of the most prominent breeders of blackberries is followed by a discussion on the origin of the loganberry and allied berries concluding that the loganberry is most probably a red-fruited sport of the wild blackberry. [See, however, Crane and Darlington in *The origin of new forms in Rubus*, I. *Genetica*, 1927, 9 : 241-78.—ABSTRACTOR.] A list of the species which Crane considers to be of possible value for breeding is included in a section dealing with the evolution of European blackberries. An account of recent breeding work in America describes the attempts that are being made to obtain such desirable qualities as drought resistance, flavour, hardiness, size and firmness of fruit, and the absence of thorns. None of the blackberry-raspberry hybrids raised have proved to be of commercial value.

An account is given of the history of cultivated raspberries. The three species from which most cultivated raspberries are derived are briefly described, viz. *Rubus Idaeus*, *R. strigosus* and *R. occidentalis*. A number of other species are considered to have some desirable qualities which might make them valuable for breeding work. The variation in colour of fruit in the raspberry is considerable, ranging through red, orange, yellow, lavender, purple, and wine colour to black. An account is given of the work of the main research stations in the world, where raspberry breeding is being carried out and also of the work of private breeders of raspberries. Lloyd George, Newman, Herbert and London have proved exceptional parents at New York Agricultural Experiment Station. Latham, the leading red variety of the West, was raised at the Minnesota station. In England N. H. Grubb at East Malling, Kent, has used Pynes Royal, Lloyd George, Red Cross and Preussen as parents. The four selections chosen for field trial were all self-pollinated progenies of Pynes Royal \times Lloyd George hybrids. M. B. Crane and W. J. C. Lawrence of John Innes Institute have studied the inheritance of sex, colour of prickles and fruit, and hairiness. Reference is made to the work of Newman and Adams of Canada and Pyne of Devon, England, in raspberry breeding. Everbearing raspberries such as Ranere and autumn-fruiting varieties such as Lloyd George are briefly described. Finally there is a section on the technique of raspberry and blackberry crossing.

A.B.B.

53. DARROW, G. M. 634.72-1.523
Improvement of currants and gooseberries.
Yearb. U.S. Dep. Agric. 1937, pp. 534-44, bibl. 4.
 Currants and gooseberries are more extensively raised in Europe than in the United States. Red currant bushes were ordered from Europe for Massachusetts colony in 1629. Most of the red currant industry in the United States was based on European varieties until about 1890. Fay, Wilder, Red Cross, Diploma and Perfection were raised in the United States from 1868 to 1887 and after their introduction quickly became important varieties and now constitute 85% of the total red currant acreage. The European currant is exclusively cultivated in Europe and to a less extent in Canada. The United States Department of Agriculture advises against its culture where white pines are the forest trees owing to its susceptibility as an alternate host for the white-pine blister rust fungus. The American black currants are much less susceptible. Though cultivated as a garden crop there is very little commercial acreage of this fruit. The chief variety is Crandall. An account is given of the relation of currants and gooseberries to the white-pine blister rust. Several species of currants are described in detail. The material available for gooseberry breeding work is described. All European gooseberries are derived from one species, *Ribes grossularia*, but a number of other species are natives of North America and several are promising for breeders. The chief aim in currant breeding is to raise varieties resistant to leaf diseases. Hardiness, drought resistance and vigour are qualities which should be combined with this resistance. With gooseberries the aim of plant breeders is to combine fine flavour and attractive appearance with resistance to leaf spot, mildew and high summer temperatures. Pixwell, Como and Fredonia are among the best gooseberry varieties that have been raised in North America. At East Malling Research Station in England the production of improved varieties of red and black currants is included among the projects in the research programme. X-rays have been used to induce mutations in some of the plants used at East Malling. Breeding work with black currants is also in progress at the University of Bristol. Messrs. Laxton Bros. of Bedford, England, have introduced a number of good varieties of currants and gooseberries including Laxton's Perfection and Laxton's No. I red currants. The gooseberry variety Scania was introduced by C. G. Dahl of Sweden, and Shtambooii by I. V. Mitchurin of U.S.S.R.
 A.B.B.

54. HOBLYN, T. N., AND EDGAR, J. L. 634.723 : 581.084.2 : 519
A study of the technique of variety trials, as illustrated by the comparative yields of four black currant varieties grown in three different localities.
J. Pomol., 1938, 15 : 326-37, bibl. 2.
 The yield data of four varieties of black currant over a five-year period secured from an extensive experiment carried out simultaneously at three stations are examined. It is shown that the experimental design used, namely six 4×4 Latin squares with a four-bush plot as the experimental unit, gave exceptionally accurate results. Large differences were shown not only between the gross varietal yields at all stations, but also in the response at individual stations. These data were used to determine the best number of replicated plots for use in such trials. It is concluded that whereas from three to four 4×4 Latin squares would be necessary for reasonable precision at a single station, two similar squares would be ample, if the experiment were repeated at two or three stations. [Authors' summary.]

55. PAVLOVA, N. M. 634.725
The gooseberry. [Russian.]
Sci.-pop. Monograph 53, Leningrad, 1935, 120 pp., bibl. 40.
 A detailed, illustrated and tabulated work on the gooseberry. The history and geographical distribution and seasonal growth of the different varieties and hybrids are described. A key for identifying 36 of the best varieties is given and the new promising U.S.S.R. varieties are discussed. Modern methods of hybridization and the treatment of the hybrids are described. A number of diseases and insect pests are discussed and control methods suggested. Notes are given on the picking, packing and preservation of the fruit. The importance and the future prospects of this fruit, particularly of the Mitchurin and Spirin varieties, are discussed.

56. ANDREICHENKO, D. A. 634.725-1.541
On the question of accelerating gooseberry propagation. [Russian, English summary $\frac{1}{2}$ p.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 4, pp. 37-43.

Searching for a more rapid method of propagation than layering and more suitable for European gooseberry varieties in U.S.S.R. than soft wood cuttings, winter grafts on black currants (*Ribes nigra*) were tried. The experiments, which are described here in detail, were conducted by the author at the Mitchurin Research Institute in 1937. The following gooseberry varieties were used in the experiment:—Black Negus, Standard, Yellow English, Careless, Howard Lancer, Whinham's Industry, Bedford Red, Bedford Yellow, and Crown Bob. The total number of grafts made was 2,500. Both tongue and side grafts were tried with shoots from one-year-old plants. The preliminary results of this experiment can be summed up as follows:—Both stock and scion were dead on 24% of the grafts, the scion was dead on 13%, but buds formed on the stock and normal currant plants developed from them, while 63% gave a normal scion take. It is stated that gooseberries can be very rapidly propagated by the method of winter-grafting on black currant cuttings.

57. COVILLE, F. V. 634.73
Improving the wild blueberry.
Yearb. U.S. Dep. Agric. 1937, pp. 559-74.

The history of breeding experiments with blueberries (*Vaccinium* spp.) in the U.S.A. since 1908 is given here in some detail. The first cross-pollinations were made with the highbush blueberry Brooks (*V. corymbosum* L.) and the lowbush Russell (*V. angustifolium* Ait.). Some of the first generation crosses were cross-pollinated, and the resulting progeny, about 3,000 hybrids of the first and second generations, were grown to maturity in the field. The outstanding variation was that in colour of fruit which included light blue, dark blue, albino and a metallic lustrous colour almost like aluminium. Up to 1936 about 68,000 pedigreed seedlings have fruited and have been carefully examined with regard to the following points:—size of berry; ease of picking; size of scar where separated from the stem; tendency of skin at base of blueberry to remain attached to the stem on picking—any such tendency meant rejection of the seedling; size of calyx—this should not be too large or it may afford a hiding place for insects; keeping quality and firmness of flesh; cracking after rain—several of the best flavoured varieties were rejected on that account; flavour—in this connexion it may be noted that more than 300 seedling plants bearing berries over $\frac{3}{4}$ in. in diameter were rejected as below standard for flavour. When a seedling is approved single buds from it are inserted in midsummer near the base of new shoots that have grown from older blueberry plants cut to the ground in the preceding winter. Next spring each shoot is cut off just above the inserted bud and no other bud is allowed to grow. By the end of the season the new top furnishes a large number of cuttings which are then struck. The author describes 16 new tested varieties noting with especial commendation the latest hybrid formed by crossing the unnamed large-berried hybrid CM 37 with Stanley, another of the new hybrids. It is named "Dixi" as signifying the producer and author's final and triumphant words to the Department from which he was retiring. Its flavour is described as sweet sub-acid and delicious. As a young plant it has produced very large berries of nearly an inch in diameter and it will shortly be submitted to its field trials.

58. DARROW, G. M. 634.75-1.523
Strawberry improvement.
Yearb. U.S. Dep. Agric. 1937, pp. 445-95, bibl. 65.

The author describes the origin of the cultivated strawberry. He states that it is derived from 2 American species, the wild meadow strawberry (*Fragaria virginiana* Duch.) of Eastern North America and the beach strawberry (*F. chiloensis* (L.) Duch.) found along the Pacific Coast. He discusses in some detail the steps which have led to the present cultivated strawberry of commerce. Consideration is given to the varieties now in favour in U.S.A., the British Isles, Germany, Holland, France, Norway, New Zealand, Victoria and Tasmania. The technique of

breeding is described and an account is given of the breeding work and the aims of the breeders at the different centres throughout the U.S.A., in England, Germany and in New South Wales. The genetics and cytology of the different *Fragaria* species are considered and certain cases of unusual inheritance in this genus are noted. A brief note shows that bud selection does not play a great part in strawberry breeding work. In an appendix are listed past and present research workers and research stations interested in strawberry problems, and in two additional tables are noted the names, parentage, particular characters and agent responsible for varieties originated by public agencies and those originated by private breeders in U.S.A., Europe and U.S.S.R. Finally under the heading "Sources of superior qualities in strawberries" the names of varieties are given which display certain pronounced characteristics which may possibly be useful for breeding, first as regards the plant, e.g. Marshall in California showing mite resistance etc., and second as regards fruit, e.g. Howard Supreme in Massachusetts, which shows superior qualities for freezing.

59. FEDOROVA, N. YA. 634.75-1.523
Interspecific and intraspecific hybridization of strawberries. [Russian.]

Bull. appl. Bot., Leningr., 1935, Ser. A, No. 15, pp. 101-10.

A preliminary report of studies with strawberries started in 1929. Interspecific and intraspecific hybridization as well as the sex inheritance problem of the strawberry were investigated. The actual number of pollinations made is not stated, but over 5,430 hybrid seeds of *Fragaria vesca* \times *Fragaria elatior* were used in one of the experiments in 1930, which suggests that the investigations were carried out on a large scale. The following notes are taken from the author's conclusions:—In the case of interspecific hybridization of strawberry varieties with different chromosome numbers only sterile hybrids and non-viable seeds were obtained, but this was not the case when cross-pollination took place between strawberries of equal chromosome numbers. Most promising and of the greatest interest for the geneticist is said to be the octoploid group with 56 chromosomes which is very rich in characters. The everbearing character and the number of flowers borne are said to be recessive characters. The greatest attention should be paid by the scientific breeder to selecting female plants, the latter varying greatly in their sex determining capacity.

60. SNYDER, E. 634.8-1.523
Grape development and improvement.

Yearb. U.S. Dep. Agric. 1937, pp. 631-64, bibl. 10.

The introduction and vicissitudes of the European *vinifera* grape in the United States are described. In view of the many failures with this type of grape in the Eastern States the grape industry was here based mainly on native species. The characters of some 14 *Vitis* species offering certain advantages for breeding are tabulated. A large number of the early crosses made were derived from crossing *V. labrusca* with *V. vinifera*. A list is given of some 80 American native grape varieties showing their parentage, their producer and date and place of origin. A section is devoted to the technique of grape breeding. A recent survey shows that in addition to the grape breeding programme of the Department of Agriculture the following State stations are conducting grape breeding experiments:—California, Georgia, Maryland, Minnesota, Missouri, New York, S. Dakota, Texas and Virginia. The chief objectives have been and are improvement in fruit quality, productivity, disease resistance and adaptability to soil and climatic conditions. The work is being carried on with American native bunch grapes, muscadine grapes, and European grapes. The particular aims in each case are discussed. It may be noted that the *Vitis vinifera* or European grape industry in the States, amounting to about 90% of the total grape production, is centred in California with plantings in other Western States. The chief work on breeding these grapes is taking place under the Dep. Agric. at Fresno, Calif., and at the Calif. agric. Exp. Sta. at Davis. The trend is towards the production of more seedless types, and improved table, raisin and wine varieties. Interesting brief accounts appear of grape breeding work in Czechoslovakia, France, Germany, Italy, U.S.S.R., and Australia. Details

are given of the places where grape breeding is in progress in the U.S. and of the workers concerned. Lists of crosses made at the different breeding centres are provided. Finally in alphabetical order lists are given of vinifera varieties of grape rootstocks and of direct producers available for breeding work in the U.S. Department of Agriculture's vineyards.

61. JACOB, H. E. 634.8-1.534/541

Propagation of grapevines.

Circ. Calif. agric. Ext. Serv. 101, 1936, pp. 36.

In this bulletin the following cultural practices are dealt with fully and clearly. *Cuttings.* Selection of parent vines, making the cuttings, storing, planting. *Layers.* Layering varieties difficult to propagate from cuttings, layering to replace missing vines. *Grafts.* Bench grafting including preparation of stocks and scions, short- and long-whip grafting, the Hengel multiple saw grafting machine (rejected in Europe but found satisfactory in trials in California), bench-grafting 1-year rooted vines, callusing, hardening, planting and after-care. *Budding.* Special reference is made to the modified "yema graft" type of chip bud. *Field grafting established vines.* *Nursery technique* including soils and location, irrigation, digging, and finally grading and storing the rooted vines.

62. KORDES, H. 577.15.04 : 634.8

Bedeutung der Wuchsstoffe für die vegetative Vermehrung der Rebe, insbesondere für die Rebenvermehrung. (The importance of growth stimulants in vegetative propagation and in particular in vine grafting.)

Angew. Bot., 1937, 19 : 543-4, bibl. 1.

The author states that treatment with β indolylacetic acid increased root formation in vine cuttings. When grafted, rootstocks were found to develop better and stronger roots after both the stock and scion had been treated with this acid. There was also a strong tendency for scions to form roots near the point of the union, but this could in the author's opinion be avoided by improving the methods adopted. Reference is made to the experiments conducted by the Baden Viticultural Institute in Freiburg, where a better percentage take was achieved between stock and scion as the result of treatment.

63. WINKLER, A. J., AND SHEMSETTIN, E. M. 634.873 : 581.145.1/2

Fruit-bud and flower formation in the Sultanina grape.

Hilgardia, 1937, 10 : 589-99, bibl. 14.

The results are described of a biological study undertaken in order to determine the line of differentiation of the fruit buds and the course of development of the primordia of the Sultanina grape in California. The most productive part of the cane is the portion between the 4th and 12th buds. The primordial clusters in the basal and apical buds do not become so large as those in the middle of the cane. Tendril primordia form later in the season than cluster primordia.

64. MACKINNEY, G. 634.873 : 581.174.1

Chlorophyll in Sultanina grapes and raisins.

Plant Physiol., 1937, 12 : 1001-4, bibl. 6.

Extremely low concentrations of chlorophyll have been found in Sultanina grapes and raisins (in U.S.A.). The evidence indicates that the ratio of the 2 components a and b is greater than that of normal green leaves, and that the chlorophyll is substantially unaltered *in situ*, but decomposes rather rapidly, on extraction, if the original has been treated with sulphur dioxide. [Author's summary.]

65. GRASBY, C. G. 634.873.4-1.542.24

Cincturing the currant.

J. Dep. Agric. S. Aust., 1937, 40 : 966-8.

In order to induce the Zante currant to fruit properly it is necessary to resort to cincturing. The best method of performing the operation is to remove a narrow strip of bark about $\frac{1}{16}$ in. wide

from round the stem of the vine when 50-75% of the corollas have fallen. The upper and lower cuts should slant towards one another to form a wedge-shaped incision which enables the bark to be removed without difficulty. Special tools are available which enable the bark to be removed in one operation; some of them, however, make the incision too wide and should be avoided. Instructions are given for making a suitable tool at home. Warning is given against too wide rings and too deep cutting; the effect of the former is to produce big crops of bold watery berries of a reddish brown colour and poor quality, of the latter to produce serious weakening. Properly made cinctures should heal in a few weeks and the process can be hastened, and in dry districts should be, by covering the wound with waxed tape or some similar material, even gummed paper having been used with success.

66. THOMAS, J. E. 634.873.4-1.541.44
Yield and quality in Zante currant with special reference to cincturing and tipping.

J. Coun. sci. industr. Res. Aust., 1938, 10 : 203-11, bibl. 7.

From experimental work with the Zante currant grown under Mildura conditions it is concluded that the loss in yield is not compensated by the improvement in grade produced by thinning the bunches below that normally resulting from winter pruning. The development of the characteristic black pigment is closely related to the sugar content and is not influenced by the use of iron. Late cincturing reduces yield and slightly improves grade. A cincture $\frac{1}{8}$ inch wide, applied when 60-80% of the caps have fallen from the flowers, has given the best results. At this period tipping, especially if cincturing is delayed, is beneficial, but later in the season it is deleterious. Tipping may be of especial value in years when cool-cloudy weather conditions prevail, or if there is exceptionally rapid growth at time of flowering.

67. WETZEL, A. 634.8-1.8
Der Einfluss der Düngung auf die deutschen Weine des Jahrganges 1934.
(The influence of manuring on the German wines of 1934.)

Ernähr. Pfl., 1937, 33 : 119-21.

This article is based on four separate large-scale experiments made with vines for a series of years in different parts of Germany. The following notes are taken from the author's summary:—A well-balanced use of N, P, K and lime not only increases the yield but also has a beneficial effect on the sugar and acid ratio in the wine. Of the different forms of potash fertilizers sulphate of potash has proved best for improving the quality of the wine. Manuring is found to improve not only the quality of poor wines and in bad seasons, but also the quality of first class wines in good years with plenty of sunshine.

68. CRANE, H. L., REED, C. A., AND WOOD, M. N. 634.5-1.523
Nut breeding.

Yearb. U.S. Dep. Agric. 1937, pp. 827-89.

Chestnuts. Breeding work in the States is now largely confined to improvement of the Chinese chestnut (*Castanea mollissima*), which shows marked resistance to blight and produces good-sized nuts. Among objectives are resistance to blight and weevils, heavy annual cropping, moderate precocity, early and quick maturing of nuts, automatic separation of nuts from burrs, and various desirable nut characteristics, including good flavour and keeping quality.

Filberts. The variety which has at present the largest number of good points is Barcelona. However, the kernels are not so free from covering over the pellicle as some others, nor are they the best in flavour, and it is felt that selection and breeding should be able to do better.

Hickories. Pecan breeders of the Bureau of Plant Industry have before them the following objectives:—hardiness, disease resistance, fruitfulness, size of nut, thinness of shell, shelling quality and kernel quality. Of the State experiment stations only those of Georgia, N. Carolina and New Mexico had done a little selection work. It is noted that breeding is in progress at Grafton Experiment Farms, Sydney, N.S. Wales, and under the direction of the Secretariat of

Agriculture in Mexico. Various other hickories are mentioned, their lack of popularity being due mainly to the difficulty of shelling.

Walnuts. (1) Black walnut (*J. nigra*) and others. The Bureau of Plant Industry has done a certain amount of breeding work in the attempt to develop new varieties, but so far without much success. A second type, the butternut (*J. cinerea* L.), producing kernels of excellent quality is extremely hardy. No breeding work has been reported. The Japanese walnut (*J. sieboldiana* Maxim) has been widely tested all over the country but has not attained great importance. It has the size and general form of a large apple tree. The Japanese walnut, the butternut and the Persian (or English) walnut (see below) blossom together about 2 or 3 weeks ahead of the black walnut. The three hybridize readily, but the hybrids, though very vigorous, show disappointing fruit set. The Persian walnut (*J. regia*) is produced on an important scale in California, Oregon and to some extent in Washington. The chief weak points in it are its susceptibility to bacterial blight, lack of hardiness sufficient to withstand conditions in the Eastern and Northern States, lack of uniformity in bearing and general lack of quality of nut. Seed has now been obtained by Crath of Toronto, Canada, from Poland which it is hoped may produce seedlings hardy in the Northern States and Canada. It has been distributed throughout Wisconsin, Minnesota, the Dakotas and Ontario, Canada. Reports of behaviour so far received vary. The Bureau of Plant Industry is planning in the near future to cross the Persian walnut with the butternut for hardiness and flavour and probably with the eastern black walnut for a blend of good flavours and possibly greater timber value. Crosses will also include the Japanese walnut, as being hardier than the Persian and growing further south than the butternut.

Almond. At present the following desirable characters, although not found in any one variety, are found isolated or a few together:—late blooming, full cropping, good harvesting, hulling and shelling, a high degree of resistance to such insects as the red spider and to various diseases, and finally general excellence of kernel. Work aimed at the combination of all or most of the above is being systematically carried on by the Bureau of Plant Industry in co-operation with the University of California at Davis.

Pistache (*Pistacia vera* L.). This will grow in hot dry regions unsuitable for almond or walnut. No breeding work has as yet been undertaken.

Tung (*Aleurites Fordii* Hemsl.). This tree was introduced into the States in 1905. Selection and breeding work has been done by the Florida Station at Gainesville and by the Georgia and Louisiana State Stations. The Florida Station found that seed nuts planted in early winter may produce seedlings up to 6-8 ft. high by the end of the first season. These can be budded in the fall. The buds will remain dormant till the following spring, when the tops are cut back. In this way budded trees suitable for transplanting can be grown in 24 months from the time the seed is planted. The aim of the breeder is the production of hardy, vigorous varieties producing large crops of good nuts rich in oil. Finally some ten pages are devoted to the fundamentals of nut breeding in general and include many practical hints of the difficulties encountered and the best methods of dealing with them. In an appendix covering 6 pages tables are given showing the centres and the workers concerned dealing with the breeding of all the above-mentioned nuts. In addition a list is given of the different nuts—together with a note of their characteristics and the name of their introducer—which are thought likely to be of value for breeding.

69. TROFIMOV, T. T.

634.51

On the natural regeneration of Juglans regia, L. ssp. fallax (Dode) M. Pop.
[Russian.]

Sovetsk. Bot., 1937, No. 2, pp. 74-80, bibl. 9.

The author's observations and trials at the Akterek Station of the U.S.S.R. Institute of Dry Subtropics with *Juglans regia* lead him to conclude that natural regeneration of walnut woods is possible when cattle are not pastured in them. It is suggested that certain areas should be kept free from cattle for 20-30 years in order that natural regeneration may take place, after which these areas could be opened to grazing and others shut off.

70. ZARUBIN, A. 634.51-1.541
Trial of walnut vegetative propagation methods. [Russian.]
Soviet Subtropics, 1937, No. 9 (37), pp. 92-3.
 A description of grafting trials with walnut trees. The experiments were conducted by the Institute of Dry Subtropics in 1936. Over 1,000 buds were made in that year to old walnut trees and to 2-year-old seedlings in the nursery. The following conclusions are taken from the author's summary:—1. Well-developed buds (but not those from very vigorous scions) taken from the top of the crown gave the best take. 2. Budding on old trees gave a better take than that on cuttings or 2-year-old seedlings. 3. The best results were given by late August buddings and the poorest by those done at the end of July. The disadvantage of both August and July budding is that the rapid bud growth is liable to suffer from the frost. 4. Ring budding was the most successful method tried and resulted in 80% take.

71. WOOD, M. N. 634.55
Almond culture in California.
Circ. Calif. agric. Ext. Serv. 103, 1937, pp. 96, bibl. 33.
 The present paper forms a revision of *bulletin* 297 and *circular* 284 issued by the Calif. agric. Exp. Station and deals with all the problems of almond growing under Californian conditions. *Varieties.* The so-called Hatch varieties, namely Nonpareil, I.X.L. and Ne Plus Ultra, receive most favourable mention and a number of others with certain desirable characteristics are also noted. Pollination requirements affecting choice of varieties are discussed. *Rootstocks.* The following rootstocks, although sometimes used, are on the whole condemned:—apricot (poor union), myrobalan (light cropping), *Prunus Davidiana* (recommended once for alkali soils but not found satisfactory), peach (no good on high lime soils and usually trees begin to decrease in production between 12 and 18 years). The best rootstock appears to be the almond and there are indications, though at present no proof, that certain types of bitter almond are the best. Ordinary cultural operations are discussed fully including pruning from the beginning. *Diseases,* including non-parasitic disorders, and pests and their control are dealt with concisely and a summary of a normal spray programme is given. Harvesting by means of poles or by jarring the larger branches with padded clubs is described. The after harvest processes of hulling, drying, bleaching and grading are described and a note is made of shelling, storing and marketing.

72. NASSONOV, V. A. 634.574 : 581.4
The anatomy of the *Pistacia vera* L. [Russian, English summary 2½ pp.]
Bull. appl. Bot., Leningrad, 1935, Ser. III, No. 4, pp. 113-34, bibl. 13.
 An anatomical description of the pistachio with an explanation of the figures in English. It is based on experiments conducted by the Turkmenistan Station of the Institute of Plant Industry in 1930.

PLANT PROTECTION OF DECIDUOUS FRUITS.

73. DENUYL, D. 632.183
The zone of effective windbreak influence.
 Reprinted from *J. For.*, 1936, Vol. 34, No. 7, pp. 7, bibl. 13.
 After discussing work published on windbreak influence the author describes experiments conducted recently at the Purdue University Agricultural Experiment Station. Instruments were set up and records taken of the effects of different types of windbreak. Anemometers were set up at 2 to 10 feet at varying distances from the windbreaks. Results are tabulated. The effectiveness of the 4-row Norway spruce windbreak, 25' high \times 50' wide, was to reduce the force of a 30 m.p.h. wind by 80% at 2 W.H. (W.H. = windbreak height in all cases) and by 50% at 6 W.H. That of a 3-row Norway spruce and American arborvitae planting, 25' high 35' wide, was 50% at 3 W.H.; that of a 2-row Norway spruce—Austrian pine windbreak, 30' high 25' wide, was 66% at 2 W.H. and 50% at 6 W.H.; that of a 1-row green willow windbreak, 12' high and 16' wide, was 40% at 8 W.H. and 5% at 15 W.H.; that of a 1-row Norway spruce wind-

break, 25' high 25' wide, was 45% at 2 W.H. Finally the reductions in wind velocity achieved by different degrees of density in the windbreak are compared.

74. POPOV, V. P. 634.1/2-2.111

Ecological analysis of the development and the frost resistance of fruit trees.

[Ukrainian, English summary 5 pp.]

Publ. Ukraine Sci. Res. Inst. of Fruit and Small Fruit Production, Kiev, 1937,
No. 26, pp. 71, bibl. 31.

This is an ecological review of studies made in 1936 with apple, pear, plum, cherry, apricot, peach and citrus trees. The development of fruit trees under natural and artificial conditions was recorded. The development of trees submitted to artificial climatic conditions approximating to those obtaining in the latitudes of Leningrad, Kiev and Sochi was studied. The actual number of trees used in the trials is not stated, but several varieties were tested in each case. In his summary the author gives the following description of the periodical development of fruit trees:—I. *The dormant period.* (a) For a certain period of time after leaf fall low temperatures are necessary for the further development of the trees, e.g. for plums 70-90 days. (b) Fruit trees pass from the dormant stage to the next stage of development more rapidly at temperatures below 5° C. Development proceeds at temperatures up to 11° C. but is considerably retarded. (c) They remain dormant if the temperature is above 15° C., and (d) in such a case no further development occurs. (e) Soil moisture is of little importance except in districts subject to winter drought. (f) The morphological sign indicating that the dormant period is over is spring flowering. II. *The bud bursting period.* (a) For a further development of trees after the dormant period is over the temperature should be above 8° C. (b) This period lasts 15-25 days or even longer according to the sort and variety of fruit tree. (c) The length of this period is strongly influenced by the humidity of the air, which may cause divergencies of 20 days. (d) Light intensity and soil moisture are of secondary importance. (e) No particular morphological sign other than blossoming marks the end of this period. III. *The growth period.* (a) This period is the time of the principal growth. (b) Development proceeds at temperatures above 15° C., under conditions of light exposure for a sufficient length of time. In Ukraine this stage takes 45-90 days. (c) In the North it is shorter owing to longer daylight. (d) In the absence of sufficient light trees cannot pass to the next stage and are unable to form fruit buds. (e) Soil moisture is particularly in demand. (f) The morphological sign indicating the end of the growth period is the appearance of fruit buds at the tops of the bud cones. IV. *The reproductive period.* (a) A certain length of time with a temperature above 15° C. is still necessary. This period varies in Ukraine from 36 to even more than 60 days according to variety and species. (b) Light in natural conditions is of the greatest importance. The provision of artificial light is not so effective here as in the growing period. (c) Temperatures below 15° at the end of this period result in an abrupt reduction of frost resistance. (d) The trees are very susceptible to moisture conditions. Reduced soil humidity improves the differentiation and the development of the fruit buds on the trees. (e) The morphological sign of a normal development for apples and pears is the noticeable differentiation of anthers until the autumn drop in temperature to 15° C. and below. V. *The period of leaf fall.* (a) To pass this stage the trees need a temperature below 15° C. and a decrease of light (12 hour day or less). (b) At temperatures over 15° C. and under conditions of excessive light the trees cannot proceed further but show instead autumnal growth and second flowering. Frost resistance of such trees drops sharply. (c) Less moisture is necessary and a surplus of water in the soil is harmful. (d) The morphological sign marking the end of this period is the autumn leaf fall. The periodicity of fruit bud development approximates closely to that of leaf buds. The first four periods (IV, V, I, II) approximately coincide in time with the respective leaf bud periods and have a similar ecological character. The fifth in the development of the fruit bud is *The fruit-bearing period.* (a) The length of this period is governed chiefly by changes of temperature and by extent of insolation. (b) The quality of fruit depends on the length of day and the humidity of air and soil. (c) Both lack and excess of warmth reduce fruit quality. (d) The morphological sign marking the end of this period is that the fruit is ripe for picking.

75. MOEN, O. 632.111 : 634.11-1.541.11
 Hårdførhetsforsøk med handelsvare av eple-og paerefroggrunnstammer i 1930-34 på Ås, i førde og i åbogen. (Winter hardness in apple and pear rootstocks.) [German summary.]

Reprint *Meld. Norg. LandbrHøisk* 1935,* pp. 11.

Trials made in the nursery of the Norwegian Agricultural College in the years 1930-4 confirm the assumption that apple seedlings originating in Holstein and in France and sold farther north are no less winter hardy than those originating in Norway. It was found that the tops of Norwegian seedlings from such types as are considered winter hardy, e.g. seedlings of old strong apple trees from Nord-Trøndelag or woodland seedlings from the south of Norway, are just as frequently damaged by frost as those of the (cider) seedlings mentioned above. In the winters of the trial the freezing back of the stocks examined was never severe enough to affect their usefulness.

76. SIDORTCHUK, A. S. 631.525 : 634.1/2-2.111
 Training fruit trees close to the ground used as a frost protection measure in Narym (Siberia). [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 4, pp. 44-6.

A brief report of successful experiments of growing fruit trees in a very cold district of Western Siberia. Large numbers of apple, pear and plum trees were planted in Narym for the first time in 1935. The planting material was obtained from Siberia, from the Far East and from the Mitchurin Fruit Research Institute. The trees were planted at an angle of 45°. In autumn their tops were bent down to the ground and covered with pine branches. In the winter of 1935 the thermometer dropped to -50° C. and late in the following "spring" (26 June) to -4° C. Despite this the trees so treated did not suffer partly owing to their being covered with snow, the normal depth of which is 1.5 m. in those parts. In control experiments made in 1935-6 and 1936-7, although Siberian varieties proved hardy, European apple varieties planted in the normal vertical position were injured by frost.

77. HARDEN, F. B. 632.111 : 634.1/8
 Combating damage from spring frosts.
J. Dep. Agric. S. Aust., 1937, 40 : 968-72.
 FRANCIS, F. R.
 Frost prevention.
Ibidem, pp. 972-3.
 HARRIS, J. B.
 Frost prevention in orchards and vineyards.
Ibidem, 41 : 129-39.

These articles deal with orchard heating chiefly from the point of view of heater installations, including automatic alarms. In the latter connexion the installation and working of a very efficient community alarm system is described (Harden, F. B.) whereby every grower on the circuit is warned of a dangerous fall of temperature within a few minutes, and the warning is continued till he rises and signifies that he has heard it. In this system the co-operation of the telephone exchange is needed. In the second paper the following orchard temperatures are noted as those at which protection is needed. For apricots 32° F. 3 feet from the ground, sultanas 31° F., currants 30° F., both at vine level. These temperatures are for spring frosts after budburst; before budburst or in its very early stages lower temperatures might be withstood. Aids to frost prevention are the removal of all timber from boundaries so as to admit free passage of air, the discing down of cover crops and no cultivation of the ground after August (in Australia). The third paper gives an account of orchard heater trials, describes erection and maintenance of heaters and alarms and the burning rates and efficiency of various types of heater.

* Received 1937.

78. RAPHAEL, T. D., AND TURNER, H. A. 634.11-2.111
Orchard heating and prevention of frost injury.
Tasm. J. Agric., 1937, 8 : 129-34.

The electrical warning and the heating apparatus used and the method of its installation and operation in orchard heating trials in Tasmania are described. The equipment was able to maintain the orchard temperature at 34° F. when the outside temperature was 28° F.

79. WILLIAMS, W. R. LL. 634.1/7-2.111
Prevention of frost damage in orchards.
N.Z.J. Agric., 1937, 55 : 215-7.

A discussion of the orchard heating methods of the Western States of U.S.A. from the standpoint of their applicability to New Zealand. It was considered that both smoke and water are of little practical value in frost prevention and that air circulation is unsatisfactory and costly. The "lard pail" type of oil heater is still as effective as any of the more expensive types except for the smoke and soot nuisance. Low stack oil heaters will eliminate this at a reasonable cost. Liquid petroleum gas (propane-butane) is too costly. Hot air (central heating) is costly to install but cheap and clean to run. Of solid fuels petroleum coke briquettes are the most satisfactory and of liquids fuels a marine Diesel oil.

80. SHMELEV, J. KH. 632.111 : 634/635
Frost resistance of fruit trees and the methods of its determination. [Russian.]
Bull. appl. Bot., Leningr., 1935, Ser. III, No. 6, pp. 263-77, bibl. 20.

The studies were conducted in the winter of 1932-3 and 1933-4 at the physiological laboratory at Detskoye Selo, and in summer in Mitchurinsk. The report is tabulated, numbers of trees and other data in different experiments being given. The author comes to the following conclusions:—Frost resistance of fruit and other trees is not constant. It undergoes great changes, depending on the summer conditions and in particular *on the moisture in the soil and on transplanting from the nursery*. A gradual drying up of the soil in the nursery during the second half of the summer induces an earlier cessation of growth in apple trees and a higher frost resistance. A wet summer, especially during the second growth period under nursery conditions encourages a stronger and more persistent growth of fruit trees and noticeably decreases their resistance to low temperatures in winter. Transplanting apple trees in spring under unfavourable summer conditions causes a delay in growth during the first period of the summer, insufficient subsequent growth and low frost resistance. The decrease in frost resistance after transplanting is considerably more in 1-year-old than in 2-year-old apple trees. The resistance of 1-3-year-old trees to frost is chiefly determined by *the summer conditions*, and partly by acclimatization.

81. MOSHKOV, B. S. 632.111 : 634/635 : 612.014.44
Photoperiodism and frost resistance of perennial plants. [Russian.]
Bull. appl. Bot., Leningr., 1935, Ser. III, No. 6, pp. 235-61, bibl. 8.

From literature cited and from his own experiments conducted in 1929-34, the author comes to the following conclusions:—1. Frost resistance of perennial plants depends on their photoperiodic reaction. The frost resistance of the growing plant can be modified in both directions by a change of photoperiodic conditions. 2. Frost resistance is a characteristic of the plant, depending not on low temperatures, but on conditions obtaining during the plant's growing period and in particular photoperiodic conditions. Natural selection results from photoperiodic conditions. 3. In order to complete the process which the plant has to go through to become frost resistant, there need not necessarily be photoperiods during the whole growing season. 4. To increase frost resistance of a plant it is sufficient to expose its top leaves to light effects for the same period of time as would be required by the whole plant. The author attributes this to the connexion between the direct photoperiodic reaction of the leaves and the process conditioning the frost resistance of the variety, and suggests that this fact could be used as a starting point for further investigations. 5. To find photoperiodic conditions resulting in maximum frost resistance of a plant, tests of the effect of more than 2-3 extreme photoperiods must be made

and other important factors must be considered. 6. The author found that short periods of light near the beginning and end of the photoperiods were of the greatest importance to frost resistance. These short periods he calls critical intervals. According to whether these coincided in time with night or day period the plant's frost resistance was found to vary from 0 to 100%. 7. Variation of degree in resistance to frost of one and the same variety in different latitudes was indicated as being caused by different photoperiodic conditions of growth. These can be modified by lengthening or shortening the day. Thus the maximum frost resistance of a plant variety can be established. 8. The ability of northern plants, accustomed to low temperatures, and the inability of southern plants to make use of the short autumn days should be considered. 9. It would be wrong to attribute frost resistance of a plant to completed or uncompleted growth and to neglect photoperiods. 10. Plants should not be regarded as neutral, for the same varieties, though flowering simultaneously in all photoperiods, are affected by frost in winter days of 17 hours' duration but not if the day is 14 hours. Tables are given. The total number of plants used in the 1930-4 experiments was 3,500, consisting of 12 types of *Robinia pseudoacacia* L.

82. DAVIS, L. D.

634.25-2.19-1.542.27

The gumming of Phillips Cling peaches.

Hilgardia, 1937, 11: 1-33, bibl. 9.

There are 4 different types of gumming occurring on the Phillips Cling peach. The types are gumming caused by external injury, early suture, dorsal and distal and late ventral gumming. All except the external injury type occur at a definite and different stage in the development of the fruit. There is a close association between gumming, split pit and embryo abortion. Delaying the thinning until about 5 weeks after the pit was beginning to harden at the tip has controlled the disease satisfactorily. The probable physiological nature of the disease is discussed.

83. DAVIS, L. D.

634.25-2.19-1.542.27

Delayed thinning as an aid in controlling the gumming of the Phillips Cling peach.*

Circ. Calif. agric. Exp. Sta. 341, 1937, pp. 14.

Four types of gumming are distinguishable in the Phillips Cling peach. (1) That due to external injury, the remedy being to remove the cause. (2) Early suture gumming, which occurs at the time when, or a little before, the pit begins to harden on the tip. Since such fruits drop naturally, no action is necessary. (3) Distal and dorsal gumming. This gumming begins to show during the third week after the pit has begun to harden on the tip and a short way along the ventral suture. (4) Late ventral gumming is characterized by a green, water-soaked discoloration of the flesh of both sides of the ventral suture. This occurs 2 or 3 weeks after the early suture gumming. It has been found by experience in California that the incidence of gumming among ripe fruits can be satisfactorily controlled by late thinning. A so-called reference date is established by cutting successive slices off the fruit at right angles to the suture starting at the tip. Before the pit has begun to harden a sharp knife will cut unhesitatingly through flesh and pit, but directly the pit begins to harden the knife will hesitate. The reference date is when the pit is yellowish at the tip and for about $\frac{3}{8}$ in. along the ventral suture, the dorsal side and rest of the pit still white and soft and the yellowish portion flinty and hard to cut. Gumming of the third and fourth types will be found to start some 2 weeks after this and to have nearly all appeared after a further 3 weeks. Thinning should, therefore, take place in the case of light crops a full 5 weeks after the reference date and in heavy crops a little earlier. It will thus be possible to eliminate the gummy fruits.

84. COONS, G. H.

631.521.6

Progress in plant pathology. Control of disease by resistant varieties.

Phytopathology, 1937, 27: 622-32.

The history and present position of the study of disease resistance in plants is discussed and the progress made is evaluated. "At present," the author remarks, "we are dealing with host

* See also previous abstract.

plants that we know imperfectly, exposing them to pathogens that we also know very imperfectly, expecting to move about genes, which we postulate and that produce, in some unknown way, effects on some unknown characteristic of protoplasm that imparts disease resistance." He upholds the recent classification of resistance into mechanical, physiological, and functional, and expresses a wish that the lessened disease resulting from "commercial resistance" due to earliness, vigour, non-bruisability, might also be classed apart and so reduce confusion of thought.

85. OTERO, J. I., AND COOK, M. T. 632.3 + 632.4 + 632.8
A bibliography of mycology and phytopathology of Central and South America, Mexico and the West Indies.

J. Agric. Univ. Porto Rico, 1937, 21 : 3 : 249-86.

This bibliography occupies the entire quarterly issue. Many of the entries are annotated.

86. BRIGANTI, G. 634.1/2-2.4 + 2.19
Il marciume radicale, cause predisponenti ed aggravanti; mezzi di lotta preventivi e curativi. (Factors favourable to and aggravating root rot. Preventive and curative treatment.)
Ital. agric., 1937, 74 : 669-74.

The phenomenon known as "marciume radicale" (root rot) covers a multitude of pathological conditions in fruit trees which end in death. The visible symptoms include the following:—foliage more or less chlorotic, the tips of twigs meagre and thin and the internodes shortened, leaves small, stunted and somewhat bunched on to one another; excessive leaf fall during summer, followed by fall of almost all the fruits while still small and the drying up first of one or two branches and then finally of the whole tree. Frequently the actual year of death is marked by excessive flower production. Excessive and especially stagnant water in the soil are generally considered to be the chief contributing causes. In the Province of Naples there would appear to be other contributing factors such as the practice of exceptionally deep planting and the use of too fresh organic manure in close proximity to the roots. In any case great success has been achieved in this southern Province with trees already showing grave leaf symptoms by the following treatment:—In February, i.e. at the end of the rains, the plant seen to be sick is excavated quite deeply just round the trunk. If the circumference of the trunk is, say 60 cm., then a hole about 50 cm. across will suffice. It must be deep, however, right down to the original roots possessed by the tree when planted there. These will be found to have rotted away or to be dead. Care must be taken not to injure the trunk or healthy roots. Diseased roots should be cut away up to their junction with healthy roots and the wounds disinfected with sulphate of iron or bordeaux and then covered with a good putty. Dead roots not showing signs of rot should be left alone. If the removal of rotten tissue results in insufficient roots remaining to sustain the tree, a large stone may be placed underneath for support. As a further precaution, but not usually necessary, every part of the remaining roots can be disinfected with sulphate of iron or bordeaux and the exposed ends covered as above. The hole is then left open till November, when it is filled in. The same process is repeated the following year [presumably if necessary.—ED.]. The excavation need not be carried out in February but is possible under Neapolitan conditions despite the strength of the sun even in June or July without danger to the tree. The removal of roots should be accompanied by an equally drastic pruning. More than 100 apple trees, of the Annurca and Sergente varieties, in every stage of disrepair due to rootrot, and treated in this way, are now, at the end of 2 years, in a thoroughly healthy state. Another 500 more or less diseased apple trees on another estate treated thus in 1936 are now in full vigour again, the holes having been left open all the time.

87. COOK, M. T. AND OTERO, J. I. 632.8
[Virus diseases of plants in Puerto Rico and elsewhere.]*
J. Agric. Univ. Porto Rico, 1936, 20 : 3 : 681-741 (received Feb., 1938).

The entire quarterly number is devoted to papers on virus diseases, all being by Cook with the exception of the last one which is by Otero and Cook. The titles are:—Records of virus diseases

* See abstract for exact titles.

of plants in Puerto Rico—Phloem necrosis in the stripe disease of corn—Description of virus diseases of plants: criticisms and suggestions—First supplement to the host index of virus diseases of plants—First supplement to index of vectors of virus disease of plants—Second supplement to partial bibliography of virus disease of plants. The bibliography is annotated.

88. CHESTER, K. S. 632.8 : 633.71

A simple and rapid method for identifying plant viruses in the field.

Phytopathology, 1937, 27 : 722-9, bibl. 9.

The paper describes an adaptation for use in the field of the precipitin test for identifying plant viruses in which use is made of crude expressed plant juices with equipment that can be carried in the pocket and can be used by untrained assistants after very little instruction. So far use of the method has been confined to 6 viruses of tobacco, but it is hoped that its range will be extended to include numerous other viruses.

89. COLE, J. R. 634.521-2.8

Bunch disease of pecans.

Phytopathology, 1937, 27 : 604-12, bibl. 6.

Bunch disease of pecans, determined in America as being definitely new to the species, is symptomized by brooming of branches and shoots, early foliation and subsequent die-back of diseased branches. It is transmittable by grafting. Pecan varieties Mahan and Schley are very susceptible, Stuart is resistant.

90. THOMAS, H. E. 634.11-2.8

Apple mosaic.

Hilgardia, 1937, 10 : 581-8, bibl. 9.

An apple mosaic found in California seems to be identical with the disease known in the eastern United States. It has been transmitted by grafting to other *Rosaceae*. Heating dormant apple trees nearly to killing point did not inactivate the virus.

91. HILDEBRAND, E. M., AND HEINICKE, A. J. 634.11-2.314

Incidence of fire blight in young apple trees in relation to orchard practices.

Mem. Cornell. agric. Exp. Sta. 203, 1937, pp. 36, bibl. 23.

Environmental conditions essential for the initiation of fireblight outbreaks at blossom time were temperature conditions which favoured abundant insect activity and suitable moisture conditions for the oozing of cankers. The severity of injury was correlated with initial blossom infections. Varieties arranged in ascending order of susceptibility were Delicious, Northern Spy, McIntosh, Cortland, Rhode Island Greening. Shoot injury was the most pronounced, being followed by spur, branch and body blight. Cultural treatments in the order of blight susceptibility produced in the trees were cultivation, alfalfa and sod. Pruning once in three years affected the distribution of fireblight injury in the trees more than it affected the amount of injury. Nitrogenous manuring, when all trees were taken into consideration, caused an increase in the total amount of fireblight injury. Taking both blight and growth factors into consideration, alfalfa without nitrogenous manuring produced the most satisfactory results. Ringing wounds became infected and ringing tended to increase the susceptibility of the trees to blight in the following season. [From authors' summary.]

92. HILDEBRAND, E. M. 632.314 : 634.1/2

Infectivity of the fire-blight organism.

Phytopathology, 1937, 27 : 850-2.

It is shown that the inoculum from a single active fireblight (*Erwinia amylovora*) canker may result in a severe epidemic of blossom blight in an orchard. The inoculum from the canker would be carried by rain or insects. Within 17 hours one cell would have produced 100,000

bacteria. Bees feeding on infested food remain contaminated for a day. It can be imagined that with 27 trees to the acre, thousands of bees to the hive and a few days of good weather during bloom a fireblight epidemic could be started from the smallest infection.

93. BRATLEY, C. O. 634.11-2.42
Incidence and development of apple scab on fruit during the late summer and while in storage.

Tech. Bull. U.S. Dep. Agric. 563, 1937, pp. 45, bibl. 34.

Studies on the development of scab (*Venturia inaequalis*) on stored apples of the McIntosh, Rhode Island Greening, Rome Beauty and Baldwin varieties are reported. Among the conclusions reached are the following:—In commercial storage only a small percentage of old lesions on the fruit enlarge. The greatest enlargement of scab lesions in store occurs in fruit packed wet in tight boxes; otherwise the type of container has little effect. The source of fruit is more important than any slight variation in storage practice in affecting the number of new lesions appearing in storage. Usually more lesions appear on fruit from poorly sprayed, heavily infected trees. Relative humidity being constant, greater enlargement of lesions occurs at 40° than at 32° F. Fluctuations of storage temperatures between 32° F. and 40° F. neither stimulate nor retard development of storage scab. Storage temperature being constant higher humidities promote greater enlargement of scab lesions. The mycelium in storage lesions is much darker than that in orchard lesions. In lesions on fruit stored at 40° F. or above the fungus no longer maintains its position between the cuticle and the epidermis but ramifies rapidly through the surface flesh without visibly affecting the cuticle. All attempts to obtain spread of scab from diseased to clean fruit in storage were unsuccessful. This indicates that the infections appearing during storage are the result of inoculations while the fruit was still on the tree.

94. KEITT, G. W.; AND PALMITER, D. H. 632.42 : 634.11-2.952
Potentialities of eradicator fungicides for combating apple scab and some other plant diseases.

J. agric. Res., 1937, 55 : 397-437, bibl. 34.

In small scale attempts to achieve chemical eradication various mixtures of aqueous solution of copper sulphate, milk of lime and certain arsenical compounds, chiefly calcium and zinc arsenites, were highly effective, often completely preventing production of ascospores in individual tests. Results from the use of over 200 formulas are reported. The epidemiology of scab was studied in 2 orchards, about 100 yds. apart, one sprayed with copper-lime-arsenic mixtures in autumn and the other unsprayed. Neither received summer sprays. Scab development in the autumn-sprayed orchard was strikingly retarded and reduced. A spring treatment of the fallen leaves with an ammonium sulphate solution killed the ascocarps of *Venturia inaequalis*. Small scale exploratory tests of the potentialities of copper-lime-arsenic mixtures for suppressing primary inocula were made in the case of 8 other disease producing fungi—and results are discussed. [From authors' summary.]

95. KIENHOLZ, J. R., AND CHILDS, L. 632.42 : 634.13
Twig lesions as a source of early spring infection by the pear scab organism.

J. agric. Res., 1937, 55 : 667-81, bibl. 19.

In observations in the Hood River Valley, Oregon, primary spring infections with pear scab, *Venturia pyrina* Aderh., were found to result largely from conidia in overwintering pustules on the previous season's wood rather than from ascospores, few of which were ever trapped in trees. It is, therefore, suggested that early sprays should be timed by conidial dispersion from twig lesions. Consistent and thorough spraying during the growing season largely prevented twig infections. Lime-sulphur was effective in burning out active twig pustules, but could not be used on tender-skinned varieties after the young fruit was exposed without causing injury. Applied in the delayed-dormant stage lime-sulphur reduced primary spore numbers so that additional sprays gave satisfactory protection against reinfection. Environmental factors are important in natural control.

96. PLAKIDAS, A. G. 632.48 : 634.71
The rosette disease of blackberries and dewberries.
J. agric. Res., 1937, 54 : 275-303, bibl. 10.
 The experimental data gathered during 5 years' study of rosette disease in blackberries and dewberries are here presented. For a non-technical account of the disease with recommendations for its control by the same author the reader is referred to *Bull. Louisiana agric. Exp. Sta.* 250, published in 1934. The organism responsible, formerly known as *Fusisporium* ? *Rubi* is here renamed *Cercospora Rubi* (Winter) comb.n.

97. TOMKINS, C. M., AND TUCKER, C. M. 632.411 : 635.611
Phytophthora rot of honeydew melon.
J. agric. Res., 1937, 54 : 933-44, bibl. 11.
 A disease affecting mature and immature fruits of the honeydew melon was identified as *Phytophthora Capsici* Leonian. Symptoms are small, incipient brown or water soaked spots which enlarge to form large, water soaked lesions. Internally the tissues invaded are soft, water soaked and odourless. Excessive irrigation, poor drainage and high temperatures are found to be the chief factors predisposing to infection.

98. WATERSON, J. M. 634.711-2.411
A note on the association of a species of *Phytophthora* with a "die-back" disease of the raspberry.
Trans. bot. Soc. Edin., 1936-7, 32 : 251-9, bibl. 5.
 A die-back of Lloyd George raspberry in Scotland is characterized by the death of young shoots which curl downwards in a shepherd's crook, pointing usually outwards. The buds on canes from the previous year may fail to develop or flowers may be formed which fail to set fruit. The whole stool becomes unhealthy and eventually dies except in very mild cases. The disease is generally very localized in the field. Root formation is found to be restricted and the young roots usually show a definite die-back from their tips. The diseased root tissue shows a brown discoloration. The disease closely resembles the black root rot described by Harris. The author found a species of *Phytophthora* associated with this disease. It belongs to the *cactorum-omnivora* group but has so far defied isolation and indeed definite proof of its pathogeneity. He feels justified in considering that the fungus is a primary parasite, which, under conditions unfavourable to the host plant (such as excessive moisture), may assist the invasion of secondary organisms.

99. BROWN, N. A. 634.736-2.48
Blueberry galls produced by the fungus *Phomopsis*.
Phytopathology, 1938, 28 : 71-3.
 A *Phomopsis* species was isolated from galls of Oregon blueberry plants and its pathogeneity proved by inoculation. It differs from the *Phomopsis* producing stem-tip blight of blueberry. Control consists in removing and burning all affected parts.

100. MONTGOMERY, H. B. S., AND MOORE, M. H. 632.952
A laboratory method for testing the toxicity of protective fungicides.
J. Pomol., 1938, 15 : 253-66, bibl. 16.
 The authors are of the opinion that the method evolved is reliable for comparing fungicides in the laboratory. Whether the same results could be got in the field needs further investigation. After reviewing the literature on the subject they describe their own technique, summarizing it as follows:—With a fine-bore pipette, quantities of 0.015 c.c. each of the liquid fungicide are spread uniformly over circular areas, each 15 mm. in diameter, delimited on glass slides. When the liquid has evaporated and the deposit is dry, 0.04 c.c. of a suspension in water of washed conidia from a pure culture of *Venturia inaequalis* is applied in a similar manner, and the slides are then stored in a saturated atmosphere at 20° C. At intervals counts of germination are made. When desired, the spray-deposit is washed with water before the conidia-suspension is applied.

A description is given of the growth of *Venturia inaequalis* in pure culture on sterilized apple wood, the production of conidia and the freeing of the conidia-suspension from nutrient by centrifuging. A method is presented for rapidly assessing the results of treatment on the fungus according to the mass appearance of conidia germination. Tests with copper- and sulphur-containing inorganic substances and with certain organic compounds are tabulated and discussed. Among the organic compounds tetramethylthiuram disulphide was found to be highly fungicidal.

101. HOPKINS, J. C. F. 632.4 : 634.11

A programme for the control of diseases of apple trees in S. Rhodesia.

Reprinted from *Rhod. agric. J.* as *Bull. Minist. Agric. S. Rhod.*, 1937, 1040,
pp. 12, bibl. 5.

Mildew (*Podosphaera leucotricha*), black rot (*Physalospora Cydoniae*), bitter rot (*Glomerella cingulata*) and blister disease (*Coniothecium chomatosporum*) are the diseases most commonly found in apple trees in S. Rhodesia. They are here described and the life histories of the fungi in question are discussed in relation to control measures. A disease control schedule is suggested.

102. DOTTI, F. 632.42 : 634.11-2.952

Pregi e difetti della poltiglia bordolese e del polisolfuro di calcio usati sui meli in vegetazione. (Advantages and disadvantages of bordeaux mixture and of lime-sulphur used on apples in the growing season.)

Riv. Frutticoltura, 1937, 1 : 197-224.

Further experiments by the author in 1937 [for earlier trials see *H.A.*, 1935, 5 : 600] on the comparative merits of lime-sulphur and bordeaux are here described in detail. They show that, although the control of scab by lime-sulphur was in some cases equal to that obtained with bordeaux, in others it was not quite so good, and in some was definitely poor. Despite this the scorching and consequent deterioration in colour of fruit and the fall of leaves and fruit which are liable to follow the use of bordeaux leads the author to make the following recommendations (for northern Italian conditions):—1. On all varieties not particularly susceptible to scab, e.g. on Renette of Canada, Durello, Rosa Mantovana, Delicious, King David, Permain Doré, Annurca, Carla, Winter Winesap, Gravenstein and Renette Ananas, lime-sulphur is preferable to bordeaux. It should have a density of about 30° Baumé and should be used at a strength of 2·5% in treatment prior to flowering, of 1·5% in the first three treatments after flowering, and of 1·0% in later treatments. 2. For varieties like Black Ben Davis, which besides its susceptibility to bordeaux injury also needs sulphur for control of mildew, or like Rome Beauty and Limoncello, which are very susceptible to mildew, lime-sulphur is preferable, despite susceptibility to scab. 3. For varieties particularly prone to scab such as Commercio, Imperatore, Abbondanza, Renette Walder, Rambour Franco, bordeaux should be used. It should be used at a maximum concentration of 1% sulphate of copper and should contain 1·5 kg. of hydrate of lime to every kg. of sulphate. 4. Whatever fungicide is used, treatments are essential at the following stages:—(a) when the leaves of the flower buds have opened but the flower bunch is still compact, (b) when most of the flower buds have separated from one another, so that the fungicide can wet the floral pedicel. A few flowers may just be opening, (c) when two-thirds of the flowers have lost their petals, (d) about 10 days after (c), (e) a further 2-4 treatments at 10-12 day intervals according to the weather, (f) final treatments 1 or 2 at the end of August or September at the coming of the autumn rains. 5. Both in spring and at the end of summer spraying should be done before rain.

103. MOZGOVOY, YU. G. 634.11-2.753

The immunity of apple trees to the woolly aphis (*Eriosoma lanigerum*)
Hausm. [Russian, English summary 7 lines.]

Bull. appl. Bot., Leningr., 1937, Ser. II, No. 11, pp. 107-51, bibl. 70.

A concise and tabulated review of the literature cited from various sources. The biological races of woolly aphis and their food specialization are described. The comparative resistance of apple varieties and the influence of surroundings upon the degree of resistance are discussed.

A description is given of pathological modifications in the plant tissues caused by the salivary secretion of the aphis. The nature and the inheritance of immunity are reviewed and wild apple trees as a source of resistant forms are considered. In the table, pp. 118-19, varietal resistance of apples to woolly aphis is recorded for Crimea, Caucasus, Turkestan, U.S.A., Argentina, France, England, Germany and Switzerland, the degrees of resistance being 0 = immune, 1 = resistant, 2 = susceptible, 3 = very susceptible. The same resistance grades are adopted in the next table, pp. 120-32, where some 517 apple varieties are arranged in the classification order worked out by Likhonos, Pashkevitch and Sigov. According to the author's data absolute immunity is found only in Northern Spy and Winter Majetin and possibly Ivory's Double Vigour, Paradiso (according to Comes in Italy), Aranciano (also called Huidoro) and Amassia (the last two quoted by Huergo in Argentina).

104. SMITH, L. M. 632.753 : 634.22

Control of the mealy plum aphid.

Bull. Calif. agric. Exp. Sta. 606, 1937, pp. 34.

Winter applications of coal tar distillate exercised better control of *Hyalopterus pruni* Geoff. than spring applications of petroleum oil and nicotine. The paste type coal tar distillate emulsion was more efficient than the miscible oil type. In field tests of tar distillate at 5 concentrations a 1·5% spray yielded good control when very efficiently sprayed, but a 2·0% spray was essential where the operation was carried out less skilfully.

105. SMITH, L. M. 632.753 : 634.22

Growth, reproduction, feeding and wing development of the mealy plum aphid in relation to climatic factors.

J. agric. Res., 1937, 54 : 343-64, bibl. 23.

A high correlation was found to exist between rate of development of the mealy plum aphid (*Hyalopterus pruni*) and daily mean temperatures. The rate of feeding was related to temperature, but for a given increase in temperature the rate of feeding did not increase so rapidly as the rate of reproduction. This results in the relative starvation of young born at higher temperatures and is offered as an explanation of wing development. [From author's summary.]

106. KNOWLTON, G. F., AND ALLEN, M. W. 632.753 : 634.71

Bramble fruit aphids.

Ann. ent. Soc. Amer., 1937, 30 : 309-16.

In this paper aphids infesting bramble fruits in the north-western United States are discussed. Anatomical descriptions are given including those of two new aphid species and that of a new subspecies.

107. S. AFRICA, UNION OF. 351.823.1 : 632.3/7 : 634.1/7

Agricultural Pest Act (Act No. 11 of 1911 as amended), **Agricultural Pests** (Citrus canker) **Act** (Act No. 10 of 1919) and **Psorosis Act** (Act No. 42 of 1927), **Proclamations, Government Notices and Regulations.**

Govt. Printer Pretoria, 1937, pp. 54 +2 loose leaves.

This publication gives in detail the most recent legislation with regard to agricultural pests including those affecting deciduous and citrus fruits in the Union of S. Africa.

108. STEER, W. 632.951

Laboratory methods for the biological testing of insecticides. 1. Methods of testing ovicides.

J. Pomol., 1938, 15 : 338-55, bibl. 7.

The author gives an account of experience at East Malling which has led to the adoption of simple methods for testing ovicides, contact insecticides and stomach poisons. Test insects should satisfy as many as possible of the following requirements:—ease of rearing, ease of

handling, ability to use a wide range of host plants, availability at convenient times of year, suitability for use as dual or treble purpose insects, i.e. as tests for ovicides, contact or stomach poisons, and lastly economic importance. At East Malling *Orgyia antiqua* L. (vapourer moth) is bred in large numbers and is used as a test of ovicides, contact and stomach poisons. *Operophtera brumata* L. (winter moth), *Aphis pomi* de G. (green apple aphis) and *Oligonychus ulmi* Koch. (red spider) are used as tests for ovicides, the eggs of the last, however, not being altogether satisfactory. Spray materials which show enough promise in laboratory tests are next applied to branches of fruit trees to test whether safe to use. They then undergo successive stages of field trial.

109. ANON. 632.951.1

The cultivation of pyrethrum in Japan.

Bull. imp. Inst. Lond., 1937, 35 : 318-33.

This article is in part a reprint brought up to date of a report published *Ibidem*, 1930, 28 : 300-42, in which are described the methods of cultivation of *Pyrethrum* in Japan, still the largest producer. The treatment after harvest is also discussed and a brief note is given of the make-up of various insecticidal compounds which are manufactured from the plant.

110. SUKHATCHEV, A. D. 632.96

Biological control of insect pests. [Russian.]

Fruits and Vegetables, Moscow, 1936, No. 2, pp. 57-8.

It was observed at the State Fruitfarm, Klyutcharevo, Moscow District in 1935, that *Syrphus ribesii* and *Coccinella septempunctata* larvae helped to a rapid recovery of an apple orchard consisting of over 250 trees badly infested with *Dentatus communis*. Previous spraying of the trees had proved ineffective. The voracity of *Syrphus ribesii* was greater than that of other larvae. The suggestion is made that these insects should be introduced into the State and Collective Fruit Farms to control *Dentatus communis* and similar insect pests. The description of *Syrphus ribesii* is quoted from Prof. Pospelov's Entomology, Ogiz, 1935, p. 401. No description is given of the more common *Coccinella septempunctata*.

111. EVANS, J. W. 632.96 : 632.75 : 634.11

The biological control of the apple leaf-hopper (*Typhlocyba froggatti* Baker).

Tasm. J. Agric., 1937, 8 : 171-3, bibl. 2.

The increasing damage done by the apple leaf hopper (*T. froggatti*) in Tasmania has led to the introduction of the mymarid wasp (*Anagrus armatus*) found by Dumbleton of the Cawthron Institute, N.Z., to parasitize the eggs of the hopper in question. Apple twigs containing parasitized eggs arrived in the winter of 1935. No sign of the parasite was found a year later, but in August, 1937, it was found to be well established and steps are to be taken to establish it in a few badly infested orchards.

112. MARCHAL, P. 632.96 : 632.79

Les trichogrammes. (The *Trichogrammae*.)

Reprinted *Ann. Epiphyt.*, 1936, 2 : 447-550, bibl. 72.

This work, which forms part of a series of investigations on the biology and development of hymenopterous parasites, deals with the *Trichogrammae*, and in particular with *Trichogramma cacaeciae*. The author makes use of the considerable literature available.

113. CRAFTS, A. S. 632.954

The acid-arsenical method in weed control.

J. Amer. Soc. Agron., 1937, 29 : 934-43, bibl. 19.

The conditions and technique necessary for optimum results and the limitations of the acid-arsenical method of killing deep-rooted perennial weeds are discussed. The mechanics of the process are explained and are, briefly, that if the foliage of a plant is rapidly killed (as by the acid)

liquid is absorbed from the xylem vessels and replaced by any available water (e.g. the dilute arsenic solution) or by air. Thus the success of the treatment depends on getting the arsenic solution into the xylem fibres of the roots before the roots have time to supply the deficit with water. On the other hand, if the evaporation from the sprayed tops is excessive, the solution will not penetrate. Too rapid evaporation is caused by high temperature and/or high wind and (as was shown by experiment) for these reasons spraying is best done at night. Failure will also result, if the leaf surface of the plant is inadequate. In these experiments the sprays were mixed in the field using a stock arsenic solution and commercial concentrated sulphuric acid in varying volumes of solution. [The preparation of these spray solutions is fully described by the author in *Hilgardia*, 1933, 7:9:361-72.—ED.] Limitations are due to a reduced toxicity at the borders of the sprayed ground, genetic differences in water-holding capacity and root penetration within any one species, variations in the physical properties of the soil resulting in differences in water-holding capacity and root penetration, the reappearance of plants that had been eaten down by rodents and so escaped the spray and reinfestation by seed, since no residual effect is produced in the soil (except perhaps on certain soils deficient in clay and iron oxides). So far fair results have been obtained on bindweed (*Convolvulus*) and knapweed (*Centaurea*). Treatment of perennial grasses and hoary cress (*Lepidium* spp.) has not succeeded. Advantages are the employment of cheap and easily obtained and prepared chemicals and the possibility of large-scale application. The combination of the treatment with others in common use is discussed.

VEGETABLE GROWING, STIMULANTS AND FIBRES.

114. WOODS, J. J. 635.1/7

Vegetable growing in the coast area of British Columbia.

Fmrs' Bull. Dep. Agric. Canada 36 (being *Publ.* 572), 1937, pp. 38.

In dealing with the general side of vegetable growing the author touches on marketing, rotation, seed, production of early vegetables, hotbed and frame production, cultivation, paper mulch methods, soils and fertilizers. He then discusses particular points worthy of attention in growing most of the common temperate climate vegetables including melons.

115. BOSWELL, V. R. 635.1/7 : 631.523

Improvement of vegetable crops—appendix.

Yearb. U.S. Dep. Agric. 1937, pp. 340-78.

The following information which is the result of a questionnaire is given in tabular form:—
 1. A list of vegetable varieties developed by State and Federal research agencies in U.S.A. and released by them for commercial use. 2. A list of vegetable strains, varieties and breeding stocks possessing some merit which are in the possession of State and Federal research workers. 3. A list of vegetable breeding and improvement activities in the U.S.A. drawn up according to States and crops. 4. A brief summary of vegetable breeding and improvement activities abroad. These tables, especially the last, should prove extremely useful to breeders of vegetables throughout the world.

116. CHESHUNT. 635.64 + 635.65 + 635.52

Experimental results of 1936.

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 17-40.

Tomatoes. The effects of root restriction were tested. Plants were grown in 10-in. pots, in cardboard boxes $8 \times 8 \times 10$ in., in wooden butter boxes $12 \times 12 \times 12$ in., in galvanized pails with a 2-in. hole through the bottom, and in wooden troughs. Statistical examination of results showed that the crop weight in tons per acre was approximately the same in all cases. The crop in the pots was, however, earliest and superior in fruit quality to that of all the rest and the trial indicates that short early crops should be obtainable by growing in pots. Planting at different distances was tested, the spacing being:—(1) in double rows 18 in. apart with a path 27 in. wide

between the double rows, the plants 14 in. apart in the rows; (2) as in (1) but plants spaced 18 in. apart in the rows; (3) single rows 27 in. apart, plants 14 in. apart in the row and (4) as in (3) but plants 18 in. apart in the row. The yield in tons per acre was practically the same in all cases and no conclusion could be reached as to quality. An experiment on sterilization with heat and with chemicals proved successful in both cases, but the treatment of tomato haulms infected with *Verticillium atro-album* with adco compound and subsequent fermentation was insufficient to eliminate infection from this fungus. Variety trials were continued. An attempt to produce a crop of tomatoes for marketing late February or March by growing in 32-in. pots failed for lack of sunlight. Results from Northumberland indicate the advantage of incorporating peat with tomato soils before planting. *Cucumbers.* Plants were submitted during the propagation stage to high light intensity, 280 foot candles, or to low light intensity, 70 foot candles, from 3 a.m. to 7 a.m. and from 4 p.m. to 8 p.m., the source being a 500 watt gas-filled lamp. Plants reacted well especially to the high light intensity treatment. Results of 2 seasons' work suggest that the greatest benefit is derived with very early crops but that the treatment is of little value for others. *Lettuce.* Manurial experiments showed a good potash supply to be most essential for successful growth. Nitrogen and phosphate are also necessary, especially the former. *Mushrooms.* Experiments are reported elsewhere.

117. BEATTIE, J. H. 631.544.4/7

Sash greenhouses.

Leaflet. U.S. Dep. Agric. 124, 1937, pp. 8.

Full particulars are given with diagrams and costs of the construction of sash greenhouses. Attention is also paid to systems of heating, both by flues and by hot water pipes. The leaflet is obtainable from the Supt. Documents, Washington D.C., price 5 cents.

118. JACOB, A. 631.8 : 635.1/7 : 581.192

Untersuchungen über den Einfluss der Handelsdünger auf die Qualität von Gemüse. (Investigations on the influence of commercial fertilizers on the quality of vegetables.)

Ernähr. Pfl., 1937, 33 : 363-6.

An investigation into the influence of manuring on the chemical composition and flavour of vegetables conducted by the Experiment Station, Berlin-Lichterfelde. In addition to chemical analyses of potatoes, carrots, salsify, red cabbage, brussels sprouts and celery, their appearance, aroma and flavour were tested by a committee of experts. The following groups of fertilizers were used: farmyard manure, farmyard manure and complete fertilizer, peat litter and NP, peat litter and NPK. The experiments with potatoes included a series of plots receiving no farmyard manure. Potash was applied in all trials in the form of sulphate of potash magnesia. The proportions in which the fertilizers were applied are given and the results are tabulated. Data indicate that a proper use of commercial fertilizers not only increases the yield but also has a beneficial effect on the quality of vegetables.

119. VOGEL, F. 631.83 : 635.1/7

Die Bedeutung der Kalidüngung für den Gemüsebau auf Grund der Untersuchungen Weihenstephans. (The importance of potash manuring in vegetable growing as demonstrated in experiments carried out at Weihenstephan.)

Ernähr. Pfl., 1937, 33 : 229-34.

A preliminary report on manuring trials with vegetables carried out for a series of years by the Weihenstephan Horticultural Institute, near Munich. The effect of 12 different mineral fertilizer treatments of 7 different farmyard or compost manurial treatments on red cabbage, celery and savoy was studied. The soil was loess. Potash manures were observed to have a beneficial effect on celery, while the yield and the quality of red cabbage and savoy were chiefly determined by nitrogenous fertilizers. The report is supported by tables and figures.

120. BEATTIE, J. H. 633.43 + 635.41 + 633.846 + 635.646

Production of carrots.

Leafl. U.S. Dep. Agric. 125, 1937, pp. 4.

Production of spinach.

Ditto 128, 1937, pp. 8.

Production and preparation of horse radish.

Ditto 129, 1937, pp. 6.

Production of egg plant.

Ditto 131, 1937, pp. 4.

The essential points in the cultivation of these four vegetables are enumerated and notes are given on choice of varieties, soils and manures, diseases and pests, harvesting and yields.

121. POOLE, C. F. 635.1 : 631.523

Improving the root vegetables.

Yearb. U.S. Dep. Agric. 1937, pp. 300-25, bibl. 44.

The improvement in the United States of the following vegetables is discussed:—turnip, rutabaga, radish, beet, carrot, and, more briefly, taro (or dasheen) (*Colocasia esculenta* (L.) Schott), parsnip and salsify. The particular difficulties encountered in breeding such vegetables are considered. An account is given of the genetics of the first five. A useful bibliography includes a number of German articles.

122. BOSHART, K. 631.83 : 635.11 + 635.13

Kalidungungsversuche mit roten Rüben und gelben Rüben (Möhren).

(Experiments with potash fertilizers on beetroot and carrots.)

Ernähr. Pfl., 1938, 1 : 1-3, bibl. 4.

During 1931-6 the effect of the different forms of potash fertilizers on different types of vegetables was studied by the Bavarian State Institute of Plant Industry and Plant Protection. This paper deals with the experiments on beetroot and carrots. The fertilizers used were 40% potash salts (muriate), sulphate of potash and sulphate of potash magnesia. In the case of beetroot each form of potash fertilizer had an equally beneficial effect on the crop. Good response to potash manuring was also observed with carrots, but the experimental data suggest the superiority of the chloride for this crop.

123. CHITTENDEN, E., AND COPP, L. G. L. 635.12 : 632.19 : 546.273.33

The use of borax in the control of brown-heart of turnips.

N.Z.J. Sci. Tech., 1937, 19 : 372-6, bibl. 1.

Brown heart of turnips in New Zealand was effectively controlled by a top-dressing of 20 lb. of borax per acre prior to sowing or by drilling in with the seeds—10 lb. borax mixed with 1 cwt. ground limestone + 1½ cwt. superphosphate per acre. When mixed (10 lb. per acre) with superphosphate alone and sown with the seed it caused serious mortality.

124. JONES, H. A. 635.25 : 631.523

Onion improvement.

Yearb. U.S. Dep. Agric. 1937, pp. 233-50, bibl. 23.

In onions the adaptability of varieties to different regions is often decided by length of day, the time at which bulb formation starts being determined by the length of the photoperiod and not by the age of the plant. American investigators have grouped the chief American varieties into classes according to the minimum photoperiod required to produce 100% normal bulbs. The inflorescence and pollination of the onion are here described. Much of the improvement work both by commercial firms and research institutes is aimed at freeing varieties from plants which are off-type and introducing uniformity. This is done by selecting bulbs which are true to type, selfing to get uniform and true breeding lines, and finally massing the apparently similar inbred lines to bring about crossing and so reintroduce vigour. Considerable work is in progress at

Davis, Calif. Both in California and at other centres the aim is the production of types resistant to disease, to attack by thrips, and to the habit of bolting, to which certain varieties are somewhat prone under particular circumstances, e.g. when a cool spring follows a warm autumn. Names and places of workers engaged on onion improvement are given.

125. MAGRUDER, R., AND ALLARD, H. A. 635.25 : 612.014.44
Bulb formation in some American and European varieties of onions as affected by length of day.

J. agric. Res., 1937, 54 : 719-52, bibl. 9.

Tests were made at the Arlington Experiment Farm in 1934 with 18 important American onion varieties under normal intensities of daylight at exposures of 10, 12, 13, 13.5, 14 and 14.25 hours and normal day length, namely 12.4 to 14.9 hours. In 1935 10 European* and 1 American variety were grown with daylight exposures of 10, 12, 13 and 14 hours, normal day length and photoperiods in which electric lighting supplemented normal daylight to give 16 and 18 hours light in all. Increasing the photoperiod hastened maturity of all varieties. The minimum photoperiod required for bulb formation differed greatly in different varieties, only 1 variety, Yellow Bermuda, producing normal bulbs (10%) with the 10 hour treatment. Six varieties required a minimum of 14 hours to produce any good bulbs. The shortest photoperiods necessary for the production of 100% normal bulbs of the different varieties are stated. Varietal season of maturity seems to depend (1) on the response to length of day and (2) to the rate of development at each indicated length of day longer than the minimum required for bulb formation. Thus, for instance, though two varieties were found to produce some good bulbs at every exposure beyond 12 hours, one of them matured its bulbs before the other in every photoperiod beyond 12 hours. The success of an introduced onion variety can, it is concluded, be fairly accurately foretold by comparing the length and the photoperiod of the growing season of its native home with those of the region into which it has been introduced. [From authors' summary.]

126. IVANOV, N. 635.31
Asparagus-bean, a new vegetable.

Soviet Subtropics, 1937, No. 8 (36), pp. 84-5.

A description of a sub-species of *Vigna sesquipedalis* (L.) W. S. Wight with an account of its characteristics and geographical distribution. The Sukhumi station of the Institute of Plant Industry was stated to have studied 20 varieties of asparagus-bean during the period 1928-32. Some of these varieties are briefly described in this paper.

127. MAGRUDER, R. 635.34/36 : 631.523
Improvement in the leafy cruciferous vegetables.

Yearb. U.S. Dep. Agric. 1937, pp. 283-99, bibl. 33.

Work begun at Wisconsin in 1910 was responsible for breeding varieties of cabbage resistant to yellows or *Fusarium* wilt. Present investigations are aimed at developing strains resistant to other diseases, or particularly adapted to definite localities, or of superior eating or storing quality. No plant improvement work has been undertaken by State or Federal research bodies with kohlrabi or cauliflower, but broccoli is receiving attention by selection and breeding by private firms. Kale improvement by seedsmen has been restricted to fixing the type or selecting for uniformity of strain. The Virginia Truck Station and the Louisiana Agricultural Experiment Station have made certain progress towards uniformity in strain. Advance in breeding technique for cabbage and allied plants has been rapid and the various problems involved in keeping over winter, testing for disease resistance, breeding for compactness, vegetative propagation, etc., have been overcome. The cytology and genetics of the different types are considered.

* From Poland, Holland, Germany, France and Italy.

128. ANON. 635.48 : 632.3
Rhubarb crown rot and allied diseases.
Ann. Rep. Exp. Sta. Cheshunt 1936, 1937, pp. 54-5, bibl. 2.
 Negative results of investigations are difficult to interpret if it is accepted that crown rot is solely of bacterial origin. They may, however, fit in with recent work which indicates that eelworm infection is frequently a pre-requisite for the development of crown rot.

129. THOMPSON, R. C. 635.52 + 635.53
Improvement of salad crops.
Yearb. U.S. Dep. Agric. 1937, pp. 326-39, bibl. 6.
 More than half this article is devoted to lettuce, brief notes being given of the more important varieties cultivated. The aim of the breeders has usually been the production of strains resistant or immune to definite diseases and considerable success has here been achieved. The centres of research and their work are given. Celery, which comes next in importance as a salad crop in the States, is considered more shortly. The chief problems confronting the breeder are celery yellows, premature seed stalk development, pithiness and early maturity. The progress made towards their solution is noted. The genetics of celery and lettuce are discussed.

130. WHITAKER, T. W., AND JAGGER, I. C. 635.61/3 : 631.523
Breeding and improvement of cucurbits.
Yearb. U.S. Dep. Agric. 1937, pp. 207-32, bibl. 34.
 The plants dealt with here are cucumbers, muskmelons, water melons, pumpkins and squashes. The results of selection and breeding experiments, especially in the U.S., are discussed. In most of them attempts are in progress to obtain good commercial varieties possessing resistance to one or more diseases, particularly to mosaic, downy mildew and bacterial wilt. Both the list of references and the names of workers and institutes engaged in breeding and selecting the cucurbits should prove very useful.

131. TKACHENKO, N. N. 575.1 : 635.63
Preliminary results of a genetic investigation of the cucumber—*Cucumis sativus* L. [Russian, English summary 2 pp.]
Bull. appl. Bot., Leningr., 1936, Ser. II, No. 9, pp. 311-56, bibl. 12.
 An illustrated and tabulated report on the genetics and breeding of the cucumber. For several years studies were made at the Nosovka Agricultural Experiment Station in the Chernigov Region and were continued in 1931 at the Ukrainian Vegetable Research Station. The total number of plants used in the experiments was approximately 20,000. The genetic analyses embraced a series of characters, for some of which quite definite conclusions as to their inheritance have been reached. Reticulation of the rind in the ripe cucumber was stated not to have been sufficiently studied. From the crosses between the most widely distributed variety, having brown non-warty rind, and *Cucumis sativus* var. *tuberculatus* Gabayev, with prominent warts on the light yellow rind, dwarf plants were obtained in the second generation. According to their geographical distribution cucumber varieties could be divided into two groups: the West-asiatic group with glossy surface of the green fruit, and the East-asiatic group with rough surface of the green fruit. Data indicate that the character of density of spines is a sign of susceptibility to mutant variation. The appearance of the gooseberry-shaped form of fruit in the "Klin" variety is one of the well-established cases of mutant variations. The inheritance of characters in the cucumber is shown in tabular form. Through further study of the "Klin" mutant three types of flowers were found on one plant, differing not only in their principal characters but also in many secondary characters. These were normal male, normal female and hermaphrodite flowers. Two types of the so-called "Japanese" variety were found, the plants of one type bearing chiefly female flowers, those of the other chiefly male flowers. The female type predominated, segregation in F_2 being in the ratio 3 to 1. Assuming that such partial dioeciousness is a transitional stage to complete dioeciousness, this inheritance scheme is the exact opposite to that hitherto considered established for sex inheritance in plants. A number of new recessive

characters resulted from inbreeding. These were pale yellow colour of the corolla, golden colour of the lower leaves, coarse venation combined with sterility, variegated leaves, deformation of first leaf, and verticillate arrangement of lower leaves. The appearance of the first four characters was observed only in single instances and various data indicated that they resulted from mutation. The author states that all cases of mutation studied by him were found to be of a recessive nature, and that the new characteristics should be regarded either as insignificant or harmful to the plant's life. Complete linkage was found to exist between the characters in each of the following groups:—1. White spine, colourless rind of ripe fruit and smooth surface without reticulation. 2. Glossy rind, absence of warts on the rind of green fruit covered with fine speckles. 3. Warty surface of ripe fruit, light yellow colour of the rind, pale green colour of leaves and of fruits (in the green stage), network of veins showing through the superficial cell strata of the fruit. 4. Oval shape of fruit of "Klin" mutant, small size of fruit, long dense hairs on the surface of ovary, smooth tight rind not liable to become covered with a network of fissures, dark stripes in the place where the principal meridional veins pass through the fruit flesh, luxuriant growth of the receptacle, tendency of the flesh to deep splitting. 5. Andromonoecism of the variety "Lemon", short barrel-shaped fruits, long dense hairs on the ovary, absence of large tubercles on fruits. Incomplete linkage was observed between the characters in the 3 following groups:—(a) Female type of plants of the "Japanese" variety; scanty branching, great length of the main stem, oblong fruits, a smaller number of fruits per plant. (b) Deformation of the first leaf, opposite arrangement of first pair of leaves. (c) Opposite arrangement of the first and second leaves and of the fifth and sixth leaves; opposite arrangement of the third and fourth, the seventh and the eighth leaves.

132. WILLIAMS, P. H. 635.63 : 632.4
Cucumber root rot.

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 43-5.

A note is given of preliminary experiments on the cause and control of cucumber root rot, a malady believed to be due to fungi or bacteria, which causes the loss of numbers of young cucumber plants either while still in the pots or when just planted in the beds.

133. BOSWELL, V. R. 631.523 : 635.64 + 633.842
Improvement and genetics of tomatoes, peppers and eggplant.

Yearb. U.S. Dep. Agric. 1937, pp. 177-206, bibl. 54.

A concise account is given of the origin and development in the U.S.A. of tomatoes, peppers and eggplant, and of the selection and breeding which have gone to their improvement. The mode of inheritance in the solanaceous fruits in general and of its results in these three vegetables in particular are discussed. The more important workers in this field are mentioned and in the case of United States workers the place where the work was or is being done.

134. FISCHER, A. 635.64 : 631.523
Die Wildarten der Tomate (*Lycopersicum esculentum* Mill.) in ihrer Bedeutung für die Züchtung frühereiter, krankheitsresistenter, lagerfester und wohl-schmeckender Sorten. (The rôle of wild growing tomatoes in breeding tomatoes for early ripening, disease resistance, firmness of fruit and flavour.)
Züchter, 1937, 9 : 231-8, bibl. 36.

A detailed description of tomato breeding. The author states that by crossing various cultivated varieties with *Lycopersicum racemigerum* varieties have been bred at Müncheberg, Mark, showing early ripening, disease resistance, firmness of fruit and greater sugar content.

135. FRIMMEL, F. 635.64 : 631.523
Tomatenzüchtung am Mendel-Institut in Eisgrub. (Tomato breeding at the Mendel Institute in Eisgrub.)
Züchter, 9 : 173-7, bibl. 11.

A description of tomatoes bred at the Mendel Institute since 1912, originally with the view to producing varieties bearing good crops of medium sized fruit with smooth surface of normal red

colour, and, if possible, ripening early. The rapid development of canning and fruit preservation has now led to modifications in breeding methods, medium sized and early ripening tomatoes being no longer particularly desired.

136. GOODALL, D. W. 635.64 : 581.11
Seasonal and diurnal changes in the water content of the tomato seedling.

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 92-6.

The author's experimental data are shown graphically, and are summarized by him as follows :—
 (1) The variation of water content through the year affects all leaves of the plant similarly. A maximum is normally reached in early spring and a minimum in the autumn. (2) Diurnal changes in water content of the leaves are small, with the exception of the young leaves in summer. These reach a minimum in the evening and attain a maximum in the early morning. This suggests that the latter is the most dangerous time for infection with mildew, which takes place most readily when the leaf is fully turgid.

137. BOLAS, B. D., AND GOODALL, D. W. 581.13 : 635.64
A further investigation of the movement of assimilate in tomato seedlings.

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 82-7.

Further experiments by the authors with tomato leaves lead them to suggest that the following conclusions may be deduced :—1. The respiration rate of the youngest leaves is exceedingly high. 2. There is a flow of assimilate from the more mature leaves to the younger leaves during the whole of the 24 hours and very little of the gain in dry weight in the youngest leaves is due to their own assimilation. 3. This flow of assimilate may reach its maximum during the afternoon and evening, this possibly being related to the accumulation of assimilate in the older leaves during the course of the day.

138. GOODALL, D. W. 635.64 : 581.145.1
Some preliminary observations on the position of the inflorescence in the tomato plant.

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 87-92.

His experimental data are summarized by the author as follows :—It is found that in summer the position of the flower truss on the main stem is related to the previous growth of the plant. Length of day affects it and it is suggested that age of seed may also be a factor concerned. The lateral shoots from the higher nodes form trusses at an earlier stage than do those from the lower nodes.

139. VOGEL, A. C. 635.64 + 635.615 : 581.175.11
Effect of environmental factors upon the color of the tomato and the watermelon.

Plant Physiol., 1937, 12 : 929-55, bibl. 63.

The optimum temperature for lycopene formation in the tomato Bonny Best and Marglobe was found to be 24° C. Ripened at 32°-38° C. yellow fruits were produced which became normal colour when returned to 20°-24° C. Fruit ripened at 40° C. remained green when submitted to 24° and 32° C. Given a suitable temperature ethylene hastens lycopene formation and chlorophyll decomposition. When the oxygen supply is decreased, lycopene formation is decreased while chlorophyll decomposition is unaltered with 24°-30° C. range. Other factors being suitable lycopene formation, unlike chlorophyll decomposition, is unaffected by light. The tomatoes on which these tests were made were picked green and stored for 12-24 hours at 20° C. before the experiments, most of which were carried out in darkness. In watermelon a change of temperature from 20° C. to 37° C. did not check the production of red pigment.

140. HARTMAN, J. D., WORK, P., AND WESSELS, P. H. 635.64 : 631.8
Tomato fertilizer experiments on Long Island.

Bull. Cornell agric. Exp. Sta. 676, 1937, pp. 12, bibl. 8.

Results are reported of experiments made at the Long Island vegetable research farm during 1924, 1925, 1926, 1929 and 1930. The soil was a Sassafras silt loam very low in total nitrogen,

phosphorus and potassium. Results lead to a recommendation of a basic application on similar soils of 50 lb. nitrogen, 150 lb. phosphoric acid and 60 lb. potash. It is suggested that 1,200 to 1,500 lb. to the acre of a 4-12-4 mixed fertilizer would be suitable. Or, if farmyard manure is available, 10 tons to the acre of this together with 720 lb. of either superphosphate (16%) or a 4-16-4 fertilizer should be given.

141. BALD, J. G.

635.64 : 632.8

Investigations on "spotted wilt" of tomatoes.

Bull. Coun. sci. industr. Res. Aust. 106, 1937, pp. 32.

In 1924-34 field experiments were made with tomatoes at the Waite Agricultural Research Institute, in which their susceptibility to spotted wilt was tested. The following notes are taken from the summary:—The records of infection took the form of field maps showing the position of each diseased plant and the date when symptoms were observed. The data were examined for variations in infection rate, and irregularities in distribution of diseased plants recorded. The infection rate rose to a series of maxima arising probably from variations in the population of the adult thrips vectors. Daily variations in the infection rate were compared with weather data. High rates were found to be related to high temperatures occurring twelve days earlier, and low rates to low temperatures. After fruiting began the twelve day relation ceased. There were slight indications also that current high temperatures depressed the infection rate. The experiments with healthy plants transferred to the field confirmed the existing relation between infection and temperature of twelve days preceding it. There was found to be a normal twelve-day incubation period of the virus in a rapidly growing tomato plant under field conditions. The incubation period was shorter in very young vigorous plants; longer and more irregular in mature plants. The chance of infection in plants in summer was equal within a range of 15 yards and even more than this distance from the source of infection. This chance was reduced by distances over 200 yards. The infection rate was stated to depend chiefly on the number and activity of the thrips vectors. The transmission of the disease was found to be due almost entirely to insects, the infective vectors (adult thrips) coming from outside the tomato plot. Irregularities in the distribution of spotted wilt are attributed to differences in varietal susceptibility, the near presence of ornamentals infested with thrips, differences in the method of watering and soil conditions. The internal resistance of tomato varieties to the multiplication and translocation of the virus was studied. Varietal differences in this respect were smallest when the inoculated plants were very small and growing rapidly, and greatest when the plant was fruiting. Dusting and spraying are discussed and an example is given of border infection of tomatoes by invading thrips in cool spring weather.

142. READ, W. H.

635.64 : 632.4

"Water-spot" of tomato fruits.

Ann. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 64-9.

The normal symptoms of water-spot are as follows:—In the green fruit a minute raised speck, dark brown and looking like dust, is surrounded by a circular zone normal in colour, which is in turn surrounded by a zone of very pale green tissue. The diameters of the fruit spots vary from 0.5 mm. to 3 mm. when first seen and rarely exceed 1 cm. on ripe fruit. When the unaffected portions of fruit turn red on ripening the outer zone remains yellowish red. Experiments show the spots to be formed when *Botrytis* spores are suspended on the fruit in minute drops of moisture similar to those formed by natural condensation during "sweating". The actual manner of the formation is obscure though possibly the spots are due to the liberation of some toxic substance when the *Botrytis* spores germinate in the drops of moisture but fail to develop further before the drops dry up. It would also appear possible from investigations of the phenomenon in the absence of *Botrytis* that *Cladosporium fulvum* may also be the cause. Hence all measures useful in the control of these two diseases should also serve to prevent water spot.

143. WILLIAMS, P. H. 632.651.3 : 635.64

A new eelworm disease of the tomato.

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, p. 63.

Anguillulina dipsaci, the stem and bulb eelworm, has now been found causing extensive spongy swellings on the stems and leaf petioles of young tomato plants. It is suggested that soil used for forcing infected narcissi should not afterwards be used for growing tomatoes without previously being sterilized.

144. ANON. 631.531.17 : 635.64

Seed sterilization.

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 57-8.

Calcium hypochlorite had previously been found effective for sterilization of lettuce seed. It has since been found to be equally efficacious for tomato seed. A full account of the method is given in the annual report for 1934, p. 45.

145. WADE, B. L. 635.65 : 631.523

Breeding and improvement of peas and beans.

Yearb. U.S. Dep. Agric. 1937, pp. 251-82, bibl. 96.

Peas. The evolution of the varieties which are at present in highest favour in the States for canning, market garden and field use is described. The agricultural experiment stations of Wisconsin and Maryland and a large number of private firms are busy breeding for particular purposes and a list is given of some 15 seed firms who have contributed to the introduction or breeding of superior varieties.

Snap beans (*Phaseolus vulgaris* L.). A brief account is given of the selection and breeding of snap beans at various centres mainly with a view to resistance to mosaic, rust, anthracnose and other diseases.

Lima beans (*Phaseolus lunatus* L.). These cannot be grown so far north as snap beans owing to the shorter growing season. Breeding work for good canning quality is being carried out by the Bureau of Plant Industry, and the Californian Agricultural Experiment Station has introduced a very hardy, high-yielding, small-seeded strain known as Hopi.

The genetics of peas and beans is discussed at some length.

146. KUTTER, H. 635.656 : 632.73

Die Bekämpfung der Konservenerbsenschädlinge im st. gallischen Rheintale.

(**The control of canning pea pests in the Canton of St. Gall.**)

Landw. Jb. Schweiz. 1937, pp. 97-120.

The worst pest of canning peas in the Canton of St. Gall is *Kakothrips robustus* Uzell, *Contarinia pisii* Winn. also occurring but doing no harm. Among recommendations made are:—rotation of crops, enticing the thrips by growing a few rows of peas which are sown very early, so as to be in full bloom in early June. The thrips is attracted and destroyed by firing 2-3 days after the first considerable hatching. A counter parasite, *Thriococetus kutteri* Fer., has been found and is worth further investigation.

147. OSBORN, H. T. 632.8 : 632.753 : 635.656

Studies on the transmission of pea virus 2 by aphids.

Phytopathology, 1937, 27 : 589-602, bibl. 13.

Pea virus 2 was transmitted by nymphs and adults of the pea, potato and bean aphids. The aphids can acquire the virus during a period of 5 minutes on a diseased plant and can transmit it to a healthy plant during 5 minutes immediately following. After feeding continuously on healthy plants for 1 hour the aphids ceased to retain the virus. Held without food the bean aphid retained the virus for 5 hours, the pea aphid for 8 hours and the potato aphid for 24 hours. No incubation period was observed in colonies that were fed for 1 day on diseased plants and then transferred to a succession of healthy plants for a total period of 14 days.

148. ANON. 635.652 : 632.3
Halo blight (*Pseudomonas Medicaginis phaseolicola*) of the glasshouse runner bean.
Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 55-7, bibl. 3.
 A consideration of the incidence of the disease and examination and germination of infected seed lead to the suggestion that provision of clean seed is essential for the prevention of this disease.

149. WILLIAMS, P. H. 635.8 : 632.4
An invader of mushroom beds new to Great Britain, and Experiments on the growth of *Oospora fimicola*, the white plaster mould of mushroom beds.
Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 45-6, and 46-8.
 The invader is *Pseudo-balsamia microspora* found growing in the casing soil and near the surface of the compost. It is suggested that all infected soil and compost should be sterilized by heat. Recently initiated investigations on the factors influencing the growth of *Oospora fimicola* are discussed. Raising the pH of the medium from 2.8 through various stages to 7.6 resulted in increased growth as the medium became more alkaline. There are indications that this was due to increased alkalinity and not to the withdrawal of the possibly toxic effect of the sodium phosphate and citrate used. Trials with manure indicate that the manure must be decomposed to a certain extent by composting before it is suitable for the growth of the fungus.

150. AINSWORTH, G. C. 632.8 : 635.64 + 635.52 + 635.9
Virus diseases.
Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 59-62.
Tomato. Work continues on bushy stunt and on the fern leaf type of mosaic. It is now proposed to name the latter "enation mosaic" from the leafy outgrowths or enations which usually develop from the undersides of certain leaflets of infected plants and appear to be diagnostic for the disease. **Lettuce.** A mosaic of lettuce was noticed for the first time in 1936 in the station glasshouse. No spread has occurred. **Ornamentals.** The difficulty of detecting the virus of spotted wilt of chrysanthemums by inoculation of tobacco and tomato plants due to inactivation of the virus has now been overcome by the use of a 0.5% sodium sulphite solution. Other virus diseases of ornamentals which are being investigated include cucumber virus in primula, mosaic or yellow stripe in narcissus, mosaic in bulbous iris, and leaf mottling in lily.

151. CHESHUNT (VARIOUS AUTHORS). 632.6/7 : 635.1/9
Animal pests.
Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 70-8.
 The following pests are dealt with:—A leaf miner of the tomato plant, *Liriomyza solani*, Macq. ; thrips injurious to the carnation plant, *Thrips tabaci*, Lind ; mushroom pests, various ; red spider mite on carnations ; rose thrips, *Thrips fuscipennis*, Hal. ; and millipedes, *Blaniulus guttulatus*, Bosc. and *Orthomorpha gracilis*, Roch.

152. CHAMBERLAIN, E. E. 633.71-2.8
Tobacco mosaic.
N.Z. J. Sci. Tech., 1937, 19 : 209-26, bibl. 28.
 An account is given of tobacco mosaic, described as the most prevalent and serious disease of tobacco in New Zealand. Early infection can bring about a reduction of yield of 44% to 78% according to variety. The mosaic is identical with Johnson's tobacco virus No. 1. Host plants are tobacco, black nightshade, Cape gooseberry, devil's thorn apple, Turkestan tobacco, egg plant, chilli and potato. [Botanical names are not given.—ED.] Juice from infected plants diluted to 1 in 1 million could still cause infection. The virus remains viable in soil for over 10 weeks, in extracted juice over 3 months and in dried leaf over 2 years.

153. HILL, A. V. 633.71-2.8
Yellow dwarf of tobacco in Australia. Big bud of tobacco.
J. Coun. sci. industr. Res. Aust., 1938, 10 : 228-30, bibl. 7 and 309-12, bibl. 14.
 The symptoms are described of a stunting disease and a big bud disease of tobacco which have caused much damage in Australia. The diseases which are transmissible by grafting and budding are attributed to viruses. Insect vectors are suspected but are not named. The big bud disease is caused by the same virus that causes bunchy top.

154. SMITH, D. C. 633.79-1.523
Varietal improvement in hops.
Yearb. U.S. Dep. Agric. 1937, pp. 1215-41, bibl. 22+9.
 An account is given of investigations on hops carried out at Corvallis, Oregon, and elsewhere in the United States and of selection and breeding work in Europe, and a list is provided of some 21 foreign investigators with addresses in Europe, New Zealand, Victoria, Aust., and U.S.S.R.

155. VIVENZA, A., AND MANCINI, E. 633.85
Piante oleaginose. I. Colza, ravizzone, lino, girasole. II. Arachide, sesamo, cotone, ricino. (Oil plants. I. Colza, rape, linseed, sunflower. II. Ground nut, sesame, cotton and castor bean.)
Ital. agric., 1937, 74 : 1037-52.
 In this special number of *Italia agricola*, devoted to the production of meat and oils, a small section deals with oil-producing plants capable of satisfactory cultivation in Italy. Brief notes are given on cultivation and on the crops which may be expected in the case of colza, rape, linseed, sunflower, groundnut, sesame, cotton and castor bean.

156. BECKER, A. 633.88-1.8
Anbau u. Düngung von Arznei- und Gewürzpflanzen in Deutschland. (Cultivation and manuring of medicinal and spice plants in Germany.)
Ernähr. Pfl., 1936, 32 : 110-3, bibl. 14.
 ANON.
Das Nährstoffbedürfnis einiger Heilpflanzen. (The nutrient requirements of certain medicinal plants.)
 Abstracted from *Die deutsche Heilpflanze*, Munich, 1937, 3 : 133 in *Ernähr. Pfl.*, 1937, 33 : 311.
 and
 DAFERT, O., AND HIMMELBAUR, W.
Düngungsversuche mit Arzneipflanzen. (Manurial experiments with medicinal plants.)
 Abstracted from *Die Landeskultur*, Vienna, 1936, Jg. 3, Nr. 7 and 8, pp. 147-9, 163-7 in *Ernähr. Pfl.*, 1937, 33 : 311-4.
 In the first of these articles an account is given of the acreage devoted to the cultivation of medicinal plants in the different German provinces. General notes on manuring are followed by particular recommendations for the manuring of *Mentha piperita*, *Origanum Majorana*, *Althaea officinalis*, *Valeriana officinalis*, *Sinapis alba* and *Foeniculum vulgare*. In the second, two tables give the chemical content of the chief medicinal plants grown in Germany and the amounts of those nutrient which they can be expected to remove from the soil. The figures are also set out graphically. In the last paper recommendations based on 25 years' work at Vienna are made for the manuring of some 15 species of medicinal plants arranged according to the 11 botanical orders to which they belong.

157. NORMAN, A. G. 633.524/5 : 581.192
The composition of some less common vegetable fibres.
Biochem. J., 1937, 31 : 1575-8.
 In a previous article on well known fibres (*Ibidem*, 1936, 30 : 831-8, *H.A.*, 1937, 7 : 400), the author pointed out that fibres were divisible into two broad groups on the basis of the xylan

content of the cellulose present and that the higher grade fibres such as flax, ramie and Italian hemp belonged to the low xylan group whereas the coarser fibres belonged to the high xylan group. An examination of 27 less common vegetable fibres, mainly tropical, showed that all belonged to the high xylan group, their cellulose containing over 13% xylan, with the exception of sunn hemp (*Crotalaria juncea*) and tucum palm (*Bactris setosa*). The properties of some of the fibres examined were such as to suggest that, if they were more easily available, commercial development might be possible.

FLOWER GROWING.

158. EMSWELLER, S. L., BRERLEY, P., LUMSDEN, D. V., AND MULFORD, F. L. 635.9 : 631.523

Improvement of flowers by breeding.

Yearb. U.S. Dep. Agric. 1937, pp. 890-998, bibl. nil. [Bibl. 564 in separate of article obtainable from Supt. Documents, Washington D.C., 20 cents post free.
—Ed.]

This extremely valuable compilation is already so condensed that abstracting is not practical. In view of the fact, however, that the editors of *Horticultural Abstracts* sometimes receive enquiries on flower breeding, they consider it of value to list the subjects which are here dealt with and which are of the greatest importance to any worker in that field. After noting the past work of amateur and professional workers the authors note the vast accumulation of data and stress the necessity for more scientific methods both in the use of these data and in planning future work. The technique of flower breeding is considered in some detail, and the methods of mass selection and line breeding and of direct hybridization receive attention. Natural mutation and the inducement of mutations by X-ray treatment are next dealt with. It is shown how the cytologist contributes to successful flower breeding, and the function and action of the chromosomes is described. Nearly 60 pages are then devoted to a consideration of past achievements and future possibilities of the plant breeder with regard to the following plants:—Amaryllis (*Hippeastrum*), china aster (*Callistephus chinensis*), canna, carnation, chrysanthemum, dahlia, gladiolus, day lily (*Hemerocallis*), iris (bearded), lily, nasturtium, rose, snapdragon, stock and sweet pea. In an appendix are given: a classification of the species *Lilium*, a list of more than 100 lily hybrids, and finally a brief survey of the scope of genetic work on ornamental plants as affecting some 138 garden species.

159. KOBEL, F., CAMENZIND, P., AND SCHÜTZ, F. 635.939.183 : 631.523
Züchtungsversuche mit *Primula malacoides* Franchet. (Breeding experiments with *P. malacoides*.)

Reprinted from *Ber. schweiz. bot. Ges.*, 1937, 47 : 284-318, bibl. 13.

The authors discuss in considerable detail the inherited factors which affect breeding work with *Primula malacoides*, showing with illustrations how mutations appear in the different parts of the plant. A description is given of seven varieties raised by workers at Wädenswil and now distributed to the trade.

160. WHITE, H. L. 635.936.69 : 632.48

Verticillium wilt of the perpetual flowering carnation.

and

ANON.

635.936.69 : 632.451.2

Anther smut of the perpetual flowering carnation.

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 48-52 and 52-4.

The control of *Verticillium* wilt is discussed under three headings:—1. Building up new beds not in contact with the old contaminated soil. Simple replacement of the top foot of soil is not effective. Mechanical barrage may be effective for a time but the penetration of roots in the course of 3 years may lead to reinfection. A chemical barrage of lime combined with sterilization of top soil would appear promising. [This method would not seem to have been

actually tested for the particular trouble. ED. 2. Elimination of the causal organism. Steam sterilization of beds, sideboards and even, if necessary, subsoil offers at present the safest method of eliminating the fungus. 3. Prevention of reinfection. Where stock is known to be infected the only method of dealing with cuttings which would appear to be safe is growing a generation in pots for the special purpose of propagation to the exclusion of bloom. Infection of water is possible and underground reservoirs fed from streams or ditches bordering the carnation houses should be eliminated. Finally it seems essential that tools used for the blocks free from disease should be segregated.

Another smut, caused by *Ustilago violacea*, is extremely difficult to eliminate and it is essential that prevention of infection should be the aim. The only way to achieve this is the early recognition of the disease, avoidance of infected plants when taking cuttings and systematic cutting out of infected shoots and buds so that buds containing the smut dust are not allowed to open.

161. WILLIAMS, P. H. 635.937.34 : 632.452
Rose rust (*Phragmidium*).

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, pp. 41-3.

Attempts to induce infection artificially in roses by teleutospores were again unsuccessful. The caeoma and uredospore stages on leaves are described.

162. YARWOOD, C. E. 635.939.516 : 632.452
Physiologic races of snapdragon rust.

Phytopathology, 1937, 27 : 113-5.

It is shown that at least 2 strains of antirrhinum rust (*Puccinia Antirrhini* Diet and Holw) exist and that varieties of antirrhinum immune to one are susceptible to the other.

163. ORCHARD, O. B. 635.937.34 : 632.42
Control of rose mildew (*Sphaerotheca pannosa*).

Annu. Rep. Exp. Res. Sta. Cheshunt 1936, 1937, p. 43.

Rose mildew was readily controlled by the application of bouisol-white oil emulsion.

164. BLAAUW, A. H. 635.944 : 581.14
 De periodieke ontwikkeling van een bol iris I. *Xiphium praecox* var. Imperator.
 (The periodical development of the Spanish iris, var. Imperator.) [French summary 17 pp.]
 Reprinted from *Verh. Akad. Wet. Amst.* (tweede sectie) Vol. 34, No. 3, pp. 90,
 bibl. 30 (being *Meded. Lab. PlPhysiol. Wageningen* 43).

In this paper the author does for the iris bulb what later Hartsema does for the gladiolus corm (see abstract 167), namely follow its development carefully throughout its history and describe it with excellent illustrations.

165. BLAAUW, A. H., LUYTEN, I., AND HARTSEMA, A. M. 635.944 : 581.14
 De grenzen der bloeibaarheid en het groeien van den iris-bol. II. (The limit
 of flower formation and the growth of iris bulbs. II.) [English summary
 2 pp.]
 Reprinted from *Verh. Akad. Wet. Amst.*, 1936, Vol. 39, Nos. 8 and 9, pp. 14
 (being *Meded. Lab. PlPhysiol. Wageningen*, 50).

The work reported here is in continuation of that described in *Meded.* 41 and 42. Attempts are being continued to find the requisite temperatures to which it is necessary to submit iris bulbs prior to their last year's growth before sale to the public. The difficulty lies in the fact that if too much cold is applied the growth of the bulbs may be hindered, and, if insufficient cold is

applied, the bulbs may flower and consequently not increase sufficiently in size and flower capacity for the following year. The results of using various temperatures during the period in which the bulbs are out of the ground are tabulated. So far the following tentative conclusions are reached:—about 17° C. is a suitable temperature to use when the bulbs are very small, but when they are larger such a temperature will result in excessive flower formation. To prevent this a lower temperature must be used first. If instead of 10 weeks cold at 5° C. only 7 weeks at 5° C. is applied and this is followed by 3 weeks at 20° C., or better at 17° C., the increase in weight of bulbs on replanting will be greatly improved while the flowering percentage will be hardly raised at all. Experiments continue.

166. BLAAUW, A. H., AND KRONENBERG, H. G. 635.944 : 581.14
 Het tijdstip der bloemvorming van hyacint en Darwintulp in Nederland en in Zuid-Frankrijk. (*The time of flower formation in hyacinths and Darwin tulips in Holland and in the South of France.*) [French summary 2 pp.]
 Reprinted from *Verh. Akad. Wet. Amst.*, 1937, Vol. 40, No. 2, pp. 123-32
 (being *Meded. Lab. PlPhysiol. Wageningen* 51).

At one time hyacinths in large numbers were planted for a year in the South of France in order to accelerate flower formation, but nowadays instead the bulbs are submitted to artificial heat treatment in Holland instead. The different stages of development reached at particular dates in the South of France and in Holland are here examined. It is found that at Ollioules in the South of France flower formation in the hyacinth is in full swing at the normal time of removing the bulbs from the soil. There soil temperature at a depth of 10 cm. often rises above 20° C. in May, whereas in Holland it normally reaches such a height in early July. This explains the reason for flower formation beginning at the end of May in the South of France as against 5 weeks later in Holland. In the case of Darwin tulips, actually an early variety Wm. Copland, flower formation was observed to start at Ollioules in the first fortnight of June and in Holland between the 1st and 15th July, sometimes just at the time of removal from the ground but more often just afterwards.

167. HARTSEMA, A. M. 635.944 : 581.14
 Periodieke ontwikkeling van *Gladiolus hybridus* var. *Vesuvius*. (*The periodical development of Gladiolus hybridus var. Vesuvius.*) [English summary 3 pp.]
 Reprinted from *Verh. Akad. Wet. Amst.* (tweede sectie) 1937, Vol. 36, No. 3, pp. 1-35, bibl. 17 (being *Meded. Lab. PlPhysiol. Wageningen*, 52).

With the aid of 5 clear double page plates the author gives a very detailed description of the periodical development of gladiolus corms throughout a period of rather more than a year. She is able to distinguish 9 stages in the formation of the flower as follows:—1. The growing point still splits off to foliage leaves. 2. The growing point broadens and rises in preparation for flower formation. 3. The first bract has split off. 4. The flower growing point can be clearly distinguished in the axil of the lowest bract. 5. The flower growing point has split off a 2-topped foreleaf on the side of the main axis. 6. Three primordia arise on the flower growing point. These later develop mainly into stamens. 7. The outer whorl of tepals develops on the outside of the staminal primordia. 8. The second whorl develops between the outer whorl of tepals. 9. Three carpels originate in fruit of the stamens, first as strips, then as small gates. The inferior ovary has already been clearly formed. All these stages are illustrated.

168. TATE, H. D., AND POOR, M. E. 635.944 : 632.7
Gladiolus insects in Iowa.
Bull. Iowa. agric. Exp. Sta. 359, 1937, pp. 20.

Most of the bulletin is concerned with the gladiolus thrips, *Taeniothrips simplex*, and its control. The remainder deals with other thrips, plant lice, the grape mealybug and various other insects which sometimes attack the gladiolus.

CITRUS AND SUB-TROPICALS.

169. TRAUB, H. P., AND ROBINSON, T. R. 634.3-1.523
Improvement of sub-tropical fruit crops : citrus.
Yearb. U.S. Dep. Agric. 1937, pp. 749-826, bibl. 90.

This is a monumental work, and whoever is looking for a complete encyclopaedia on the source, distribution, characteristics and future possibilities of the more important citrus fruits in the U.S.A. need go no farther. First are discussed the problems peculiar to citrus breeding particularly that of polyembryony, methods of breeding, objectives of the breeder, present achievements and future possibilities. Next in turn are considered the possibilities of improving sweet oranges, grapefruits, mandarins, lemons and limes according to the needs of the different regions where they are grown. A short note is given on such minor fruits as kumquats, citrons and pummelos. The part played in citrus improvement by bud selection is stressed. Rootstock selection for citrus cultivation in different parts of the States is considered. Very brief but interesting notes are given of citrus research in the following countries:—Mexico, Brazil, Chile, Argentine, Spain, Italy, Greece, Morocco, Palestine, Japan, China (Canton), India (Saharanpur and Poona), Zanzibar, Queensland, Victoria and New South Wales. The incidence of polyembryony in most citrus types is shown to have retarded progress in genetic research owing to the necessity of growing large numbers of seedlings to the fruiting stage. Previous work on the cytology and polyembryony of citrus is described and the value of particular breeding methods are discussed. An account is given of breeding results obtained by Departmental workers when crossing mandarin with other citrus, lemon with lime, trifoliate orange with citrus and fortunella species and various other combinations. Notes are made on the whole question of inheritance in citrus with particular reference to disease resistance and vitamin content. A brief account is given of results at the State Experiment Stations of California, Florida, Alabama, Texas and Hawaii. Finally in tabular form information is given on the following points:—(1) Names of sub-tropical and tropical fruit breeding stations both in U.S.A. and abroad together with names of workers at those stations. (2) Names, descriptions, source and present location of 41 citrus species and varieties introduced by the U.S. Dep. Agric. (3) A summary of citrus breeding by the U.S. Dep. Agric. between 1892-1934. (4) Bud mutations discovered by Shamel and his fellow workers of the U.S. Dep. Agric. in co-operation with the Calif. Citrus Exp. Sta., Riverside, between 1909 and 1936 in sweet orange, Eureka and Lisbon lemons, Marsh grapefruit, Dancy tangerines and limes.

170. HAMILTON, W. M. 634.3
A preliminary survey of the citrus industry in New Zealand.
Bull. Dep. Sci. Industr. Res. N.Z. 53, 1937, pp. 269, bibl. 68, 10s.

This bulletin forms a comprehensive survey of the historical, cultural and economic aspects of the citrus industry in New Zealand. An agreeably time-saving feature for the reader is the frequent summarizing throughout the bulletin of information, suggestions and conclusions and the praiseworthy elimination of any form of "padding". The rootstocks used in New Zealand are reviewed, the commonest being rough lemon, the Island sweet orange (*C. sinensis*) and trifoliate orange, while many others are being tried experimentally. The author's conclusions are:—(a) rough lemon is a good stock for lemons on all citrus soils, it may be the cause of granulation in grapefruit, and its value for sweet orange especially for those required to be held till late in the season is uncertain and requires further study; (b) in almost every N.Z. citrus soil sweet orange can only be relied on when efficient artificial drainage is provided, but given this it is probably ideal for sweet orange and grapefruit; (c) trifoliate stock is erratic in its effect on the scion, it is often incompatible but where it succeeds its effect on the fruit is markedly to improve quality; it is being used as the rootstock in double working with Cleopatra or Best's Seedling as intermediates; (d) sour orange for reasons unknown has not hitherto been used in New Zealand, but is included in present rootstock trials; (e) other stocks are still in the experimental stage. A summary of rootstock trials now in progress in N.Z. is given. Factors affecting production are discussed, each in a separate chapter. Influence of age shows a progressive increase in yield up to 20 years for lemons and probably less for oranges. Pruning probably is

most productive when it is moderate, which here means removal of dead, worn out or crossing branches and sometimes a slight opening of the tree centre but not limitation in height. Cultivation should be limited to a spring ploughing to incorporate organic matter, i.e. autumn sown cover crops, with only sufficient shallow cultivation in summer to destroy weed growth and prevent surface pan. An experimental sowing of clover or pasture grass for permanent sward as an alternative to cultivation is giving promising results. A provisional fertilizer programme is suggested subject to local modification. The question of liming is still an open one. Pests and diseases are discussed as well as all phases of harvesting and marketing. This bulletin will be found of value outside N. Zealand since the discussion of nearly every point of cultivation is prefaced by a survey of the most authoritative relevant literature.

171. LAVRYICHUK, I. 634.33-2.111

New forms of lemon cultivation. [Russian.]

Soviet Subtropics, 1937, No. 10 (38), pp. 55-63, bibl. 6.

A description of dwarf lemon trees grown in U.S.S.R.'s moist sub-tropics. In 1935-37 several varieties were tested for frost resistance. The number and the age of the trees used in experiments are not stated. Overwintering in the open without heating is stated to be possible, if the trees are covered up with mats during frost periods. The author recommends the growth of plants having a prostrate habit, particularly in the colder zones of the sub-tropics, these being not only more resistant to frost but also bearing earlier fruit and producing more regular crops.

172. DANKOV, A. I. 634.3-1.346

Growing citrus in pots on a large scale. [Russian.]

Sci. Fruitgrowing, Mitchurinsk, 1937, No. 4, pp. 47-50.

In May 1937 a conference took place in U.S.S.R., in which deputies of all the more important citrus growing institutions and organizations of U.S.S.R. took part. General directions and instructions were given for growing citrus in pots and a new, easy and original method of breeding indoor citrus was demonstrated by Yakhovsky and was approved for general use. [The "new method" is not discussed here, but it is said that thanks to it Soviet orange blossom oil (fleur d'oranges) and fruits can be obtained from 1-year-old trees on their own roots.—Ed.] Of some interest is a hybrid variety, which is said to have been produced by Mitchurin from Italian seeds, namely *Citrus Aurantium* L. var. *pumila dulcis*. The fruit flesh of this variety, also called "Novelty 1932", is red and is very palatable.

173. BRICHET, J. 634.3-1.55

L'alternance des récoltes chez les agrumes. (Alternate bearing in citrus.)

Fruits et Primeurs, Morocco, 1937, 7 : 211-4.

The alternate bearing of citrus, chiefly orange, mandarin and clementine, in North Africa is discussed in the light of American work in California. The alternate bearing habit which is more prevalent inland than by the sea can be mitigated in part by early fruit thinning, i.e. immediately after the first natural fruit drop. Such thinning does not affect, as it does in apples, the size or quality of the fruit that remains, but it does involve an increase in blossom the following year. Thinning is also beneficial in dry localities or in cases where irrigation is deficient. Even so there are still many other factors causing alternate bearing which cannot be dispelled by thinning, and the majority of these are faults of cultivation. This seems the more probable when it is considered that well run orange groves in America and Spain have managed to reduce biennial bearing to small proportions.

174. WEST, E. S., BARNARD, C., AND ALLAN, F. E. 634.31-1.55

The alternation of heavy and light crops in the Valencia late orange. II.*

J. Coun. sci. industr. Res. Aust., 1937, 10 : 215-24.

Thinning the fruit of the Valencia late orange by 30 to 40% early in the season of the on year caused a slight increase in the ultimate size of the fruit left on the tree and a considerable increase in the number of blossoms set and fruit formed in the following season. Harvesting the crop

* For I see *Ibidem*, 1935, 8 : 93-100. *H.A.*, 1935, 5 : 437.

3 months before the normal time in the on season increased the set for the following season compared with trees harvested at the normal time. When the fruit was left on the trees 3 months beyond the normal picking time the number of fruit harvested the following season was not affected, but the size was decreased. It is concluded that an early thinning of up to one-third of the crop in the on year combined with an early harvest should contribute to a more even annual yield.

175. WEBBER, H. J.

634.3 : 551.565

Influence of environment on citrus.

Calif. Citrogr., 1938, 23 : 108, 126, 130.

It is shown that temperature is the predominant factor which affects the time of flowering and fruiting of oranges. Length of day is of very minor importance. Allowing for differences due to individual or varietal characteristics and differing physical conditions 55° F. may be taken as the correct zero or vital temperature for citrus growth. Atmospheric humidity influences the size, shape, character and quantity of the fruit, the roundest, smoothest, thinnest skinned, juiciest and best flavoured fruits with the least fruit drop being grown in districts where humidity is highest.

176. HAAS, A. R. C.

634.3-1.415

pH for healthy growth in citrus.

Calif. Citrogr., 1938, 23 : 158, 176, 178, 180-1, bibl. 6.

As a result of studies, which are here described, it is concluded that citrus can grow under alkaline conditions when the nitrogen is added to the solution in the form of calcium nitrate and that the active growth of citrus roots in such cases will reduce the degree of alkalinity. In certain types of alkaline soils citrus roots can change the pH about them so as to secure adequate nutrition, in other types of alkaline soils the assistance of acid supplements may be needed. Depending on the stage of the absorption process the roots may also increase the alkalinity. The change in a solution brought about by the roots may not be to the pH best suited to healthy growth. Root rot is often attributed to lack of aeration from one cause or another. In these experiments root rotting occurred when the pH remained near 8.1, although an abundant supply of air was run continuously through the culture solutions. Vigour was quickly restored to such of these rotting roots as remained alive by the addition of sufficient acid to the culture.

177. ESSELEN, D. J.

634.3-1.67

Citrus irrigation practices, with special references to soil moisture studies in two orchards in the Eastern Transvaal.

Sci. Bull. Dep. Agric. S. Afr. 159 (*Plant Ind. ser. 19*), 1937, pp. 57, bibl. 20, price 6d.

The principles of irrigation are discussed and correct irrigation is shown to consist of (a) irrigating all the dry soil, and (b) not irrigating a wet soil. The unsatisfactory distribution of water in the root zone by means of 4 straight furrows is shown and several other alternative systems are described. In view of the fact that those portions of trees of which the corresponding roots are in the dry zone between trees and seldom if ever wetted are equally as productive as the other portions receiving regular water it is suggested that (a) the necessity of applying readily available nitrogen in relatively high concentrations during spring has been over-emphasized, or (b) that contrary to Auchter's* findings, there is a ready translocation of nutrients from the roots in irrigated soil to the tops served by roots in dry soil [from a paper shortly to be published by W. A. Roach, East Malling, it will be seen that the author's suggestion in (b) and Auchter's results can be reconciled.—Ed.]. In the orchards used in this study 56% of the root system was concentrated in the 6-24 inch depth and 44% in the 24-48 inch depth. The water requirements of these orchards are discussed. The rate of fruit growth may be used as a guide for determining the intervals between irrigation, provided the changes brought about by climatic fluctuations are not ignored. The immediate moisture requirements of the root zone can only be determined by examination of the soil.

* Auchter, E. C., *Bull. Md. agric. Exp. Sta.* 257, 1923.

178. KHACHATURYAN, S. A., AND TOKHADZE, I. G. 634.322-1.67
Experiments in irrigating mandarins. [Russian.]
Soviet Subtropics, 1937, No. 6 (34), pp. 67-76.

A description of experiments carried out in 1934 at the Tchakva branch station of the Institute of Tea Culture and the Tchakva State Farm in 1935. In the 1934 trials 90 twenty-five-year-old trees were used, in the second experiment 70 seven-year-old trees. Tests were made with 5 and with 10 buckets of water per tree. Among conclusions reached were the following:—Under the conditions obtaining in the moist Black Sea coastal areas the irrigation of mandarins gave good results, and the practice should, therefore, be adopted in moist subtropical regions. Irrigation proved to be effective on twenty-five-year-old trees not only in the dry summer of 1935 (good crop year) but also in 1934, a normally wet year. The irrigation of young trees proved more effective than that of the old trees. Larger and more evenly sized fruit resulted from irrigation. The fruits were not chemically analysed. Vegetative growth of seven-year-old trees was greater in the plots where irrigation was done. Better results were obtained from irrigating with 5 buckets than with 10. It is suggested that the cause of this lies in the root system and that nutrients were washed away into deeper soils when greater quantities of water were used. It is therefore suggested that future trials should be made with 2-3 buckets per tree at a time, the water being sprayed. Differences in fruit abscission were slight and could not be registered. To estimate the economic value of irrigating further large-scale experiments are necessary.

179. ALLWRIGHT, W. J. 634.31-1.8
Studies in relation to fertilizer requirements of citrus trees in the western Transvaal.
Publication (mimeographed) *S. Afr. Coop. Citrus Exchange*, 1937,
 pp. 70+17+28+3, bibl. 24.

After a summary of the commonly expected effects of nitrogen, potash and phosphate on citrus trees, and a survey of manurial and irrigational methods used in the western Transvaal, experiments undertaken simultaneously in three commercial orchards on Navel, Valencias and seedlings are described. A uniformity trial was run at the same time to guide future experimenters, and showed the best size of plot to be 6 or 8 trees. All the trees were on rough lemon stocks and were growing on a quartzite soil inherently deficient in all three manurial elements. The Navel orchard was irrigated on the furrow system in 1932, modified flooding 1933 and complete basin 1934-5. The Valencias had basin irrigation over half the orchard in 1932 which was gradually extended till it covered the whole area in 1934. This method was used for the seedlings the whole time. Four randomized blocks were made in each case, with plots corresponding to all eight combinations of no fertilizer, nitrogen, potash and phosphate, together with extra plots for sulphate of ammonia plus bone meal and plus cattle manure in the case of the Navel and Valencias. Eight trees were allotted to each plot, except for the seedlings, where six trees per plot were used. Single rows of guard trees separated the plots. All the statistical working is clearly shown, the methods used being the analyses of variance and covariance. Sulphate of ammonia and cattle manure gave the greatest increase in yield. The size of fruit of Navel was decreased by nitrogen and potash, but Valencias were unaffected. Juice was decreased in all cases by sulphate of ammonia alone, and increased by superphosphate. Potash increased the juice of seedlings. Sulphate of ammonia and cattle manure made less difference than ammonia alone. Generally speaking superphosphate diminished soluble acid content, and nitrogen increased it. Potash increased it in all cases. The soluble solids-acid ratio was consistently raised by superphosphate, and lowered by sulphate of ammonia. In general the addition of cattle manure to sulphate of ammonia lessened its effect on the ratio, which was mostly decreased by potash. Observers considered that superphosphate alone gave the best fruit, and sulphate of ammonia the worst, for, though the colour was increased, the rind was much thicker. Nitrogen darkened and improved the colour of the foliage, and prevented the formation of dead wood. Cattle manure added to sulphate of ammonia increased its value. The dimensions of the trees and the soluble solids content of their fruit were not significantly changed by any manurial treatment, but all the above observations varied significantly with the years. A list of other similar experiments is included, and their results compared with those found in the western Transvaal.

S.C.P.

180. DRAGAVTSEV, A. P. 634.322-1.542.27

Fruit thinning mandarins. [Russian.]
Soviet Subtropics, 1937, No. 4 (32), pp. 67-75.

A description of experiments conducted by the Crimea research institute. In 1934 preliminary investigations were made on 10 trees. In 1935 a thinning experiment on a larger scale was made and in 1936 its results were studied. 115 six-year-old mandarin trees were used at the Adler Station and 25 twenty-year-old trees at the Sochi research station. Treatments consisted of:—1. The removal of 50% of the buds. 2. The removal of 75% of the buds. 3. The removal of 50% of the fruits set. 4. The removal of 75% of the fruits set. 5. Control. The Gusev method of thinning was applied. All data are tabulated. Thinned trees in Adler bore a greater percentage of large fruits than the control. No change in the size of the fruit was observed in Sochi, but an increase of vegetative growth during the first growing period was noticed. The thinning had no influence on either quality or quantity of the fruit on Sochi trees in 1936. Data so far available indicate that regular yields can be obtained there without thinning.

181. BRILLIANT, V. A., AND MIRIMANIAN, V. A. 634.33 : 581.132

On seasonal changes of photosynthesis in lemons as affected by different types of winter covering. [Russian.]
Sovetsk. Bot., 1937, No. 3, pp. 54-63, bibl. 5, also *Soviet Subtropics*, 1937, No. 9 (37), pp. 64-6.

In 1935-6 trials were conducted by the U.S.S.R. Scientific Research Institute at Sukhum in which the relation of photosynthesis and growth of lemon trees to different winter coverings was tested. A consideration of published work and of their own results allows the authors to reach the following conclusions:—Dark covers made of maize-stems and mulch paper lead to great exhaustion, which is noticeable in the plants during the spring and early summer. They are, therefore, harmful. Covering with acetylcelluloid film initially causes a great rise of photosynthetic activity, and also exhausts the plants, the effect being evident throughout the greater part of the summer. Gauze covers on the other hand result in optimum photosynthesis, growth and cropping.

182. SINCLAIR, W. B. 634.31 : 581.1 : 632.19

Diastatic activity of orange leaves as affected by time, temperature, pH and certain zinc salts.

J. agric. Res., 1937, 54 : 609-19, bibl. 15.

This paper gives the results of experiments on the diastase of orange leaves made in order to determine whether diastatic analysis can be used as a means of measuring the effect of treating citrus trees with various chemical agents such as $ZnCl_2$ and $ZnSO_4$.

183. STRICKLAND, A. G. 634.3-2.19

Mottle-leaf of citrus. Preliminary note on correction in S. Australia with zinc sprays.

J. Dep. Agric. S. Aust., 1937, 40 : 579-85.

The application of zinc sprays to mottle-leaf affected citrus trees in several districts in South Australia has led to a marked improvement in tree health and the disappearance of mottle-leaf symptoms. It is suggested that whatever other adverse factors may be associated with the mottle-leaf condition (nematode infestation, soil salinity, lack of humus, etc.) these are only indirectly contributory and not the main cause, which can now be definitely assigned to zinc deficiency. The treatment which has proved successful is to spray at any time of the year, though preferably not near harvest time, with a mixture of 3 lb. zinc oxide per 100 gallons. water with a spreader, 3 gallons. per 100 gallons. of lime casein or skim milk.

184. CHAPMAN, H. D., VANSELOW, A. P., AND LIEBIG, G. F., JR. 634.3-2.19 : 546.47

The production of citrus mottle leaf in controlled nutrient cultures.

J. agric. Res., 1937, 55 : 365-79, bibl. 11.

This is a progress report of successful trials in which mottle leaf was produced in citrus by the omission of zinc from the culture solution and was not only prevented from occurring but also

cured by the addition of zinc to affected plants. The plants grown in the best lighted part of the glasshouse, intensity about 80% of that outside, were more severely mottled than those not so well lighted. There was indication that plants grown under high nitrate conditions were more mottled than those under low nitrate conditions (not starvation). Increases in phosphate accentuated mottling, whether by reason of decreased zinc solubility in the solution or of decreased zinc availability in the plant. Although the continued presence of phosphate accentuated both mottle leaf and root rot (gelatinization), these two disturbances are not necessarily related to one another and each actually occurred without the other. The results tend to confirm the view that zinc is an indispensable plant food, without which mottle leaf occurs, rather than the view that it functions as an antiseptic or corrective.

185. ANON. (PALESTINE).

632.183 : 634.3

Windbreaks.

Agric. Suppl. 20, Palestine Gaz. 711, Aug. 19th, 1937, pp. 141-4.

The advantages of windbreaks for citrus orchards in Palestine are discussed. The loss caused by westerly winds in the spring of 1937 amounted to 400,000 boxes of dropped fruit while the value of the growing crop was diminished by the increase in second grade fruit arising from wind damage. In 1935 the hot easterly winds reduced the citrus crop by 2 million boxes. The north-easterly winds in 1937 reduced the crop by 500,000 boxes. Temporary windbreaks are necessary while the permanent ones are growing. *Ricinus* (castor oil) is less used now owing to its susceptibility to pests and diseases. *Crotalaria juncea* (sunn hemp) and *Sesbania aegyptiaca* are good substitutes. The former grows 6 feet and the latter about 9 feet in a few months. Neither is very resistant to cold. Permanent windbreaks suggested are *Cupressus pyramidalis*, *C. horizontalis*, *C. macrocarpa*, *C. arizonica*, *Casuarina*, *Grevillea*, *Eucalyptus* and Tamarisk. These trees will attain 25-30 feet in 7 or 8 years. The densest windbreaks should be planted on the northern side. With all windbreaks an outlet for air currents should be left at the lower end of the plot to avoid the establishment of frost pockets. Planting distances are given for the various trees suggested. All varieties should be topped every two years to encourage spreading. The trees should be liberally manured and irrigated and a trench opened 5 feet deep and 5 feet from the trunks every year. These measures will keep the roots from robbing the neighbouring fruit trees. Investigations recently carried out by the Department of Agriculture showed that 4% less fruit fell during wind on a fully protected than on an unprotected plot and that the percentage of first grade fruit was higher in the protected plot. A lightly protected plot gave intermediate results.

186. KLOTZ, L. J., AND BASINGER, A. J.

634.31-2.19

Water spot of Navel oranges.

Calif. Citrogr., 1938, 23 : 115.

Water spot is a non-parasitic breakdown of the rind of citrus fruits, the most important feature being the imbibition of external water by the albedo of the rind. The invasion of this water-soaked area by decay-producing fungi causes rapid breakdown known as water-rot. The trouble occurs in particular in Navel oranges in California during the rainy season. Abrasions, insect punctures, large open navel convolutions and the accompanying growth cracks are the usual starting points of water spot. The possibility of control by means of a liquid paraffin emulsion spray is being examined.

187. BARTHOLOMEW, E. T., AND WALTON, B. S.

634.31-2.111

Further studies on the relation of low temperature to granulation.

Calif. Citrogr., 1938, 23 : 163, 192.

The data obtained from the examination of 25,000 Valencia orange fruits from various groves in California indicate that, while low temperature may cause granulation to appear or to increase in fruits so predisposed, it will not affect those not predisposed. Fruits from the same samples might be frozen only, frozen and granulated, or granulated only. Much injury that is now mistaken for granulation could be avoided by keeping the grove temperatures above the danger point.

188. CITRUS PRESERVATION TECH. CTTEE. 634.3-2.4-1.564
Mould control in citrus fruits.
J. Dep. Agric. S. Aust., 1937, **40** : 627-34.
 In this circular, issued by the Citrus Preservation Technical Committee of Australia, the types of wastage in citrus and the many ways in which injuries with the resulting infection can be caused to the fruit are discussed with the object of instructing growers and packers in the use of methods tending to eliminate or at least to reduce such wastage.

189. FAWCETT, H. S., AND KLOTZ, L. J. 634.3-2.4
A new species of *Candelospora* causing decay of citrus fruits.
Mycologia, 1937, **29** : 207-15, bibl. 4.
 A description is given of a fungus first isolated from an orange at Citra, Florida, in 1932. Inoculations showed it capable of causing decay in lemons, oranges and grapefruit, the mature fruit being more susceptible than the immature. It has been named *Candelospora Citri*.

190. THOMPSON, W. L. 634.3-2.654.1
Early and late injury of rust mites in oranges.
Citrus Ind., 1937, **18** : 7 : 5, 9, 20, 21.
 It is shown that the citrus rust mite of oranges (scientific name not given) produces a speckled type of injury on rapidly growing fruit and that a smooth, solid type of infestation occurs when the fruit is nearing maturity. To effect proper control early spraying before there is fruit on the trees is advocated. It is usual to start spraying when the field, in leaves examined under a lens, is 30-35% infested. This, in the opinion of the author, is too late.

191. BOYCE, A. M., AND MAXWELL, K. E. 634.3-2.654.1
The new citrus bud mite.
Calif. Citrogr., 1938, **23** : 109, 152.
 A description and an account of the habits are given of the citrus bud mite, *Eriophyes sheldoni*, n.sp. The usual sprays and fumigations used to control other citrus pests will probably control this mite also. It is not yet a pest of economic importance.

192. MCKENZIE, H. L. 632.752
Morphological differences distinguishing California red scale, yellow scale and related species (*Homoptera-Diaspididae*).
Univ. Calif. Publ. Ent., 1937, **6** : 323-36, bibl. 5.
 How red and yellow scales can be distinguished morphologically by differences in the pygidium is described.

193. KLEIN, H. Z. 634.3-2.944
Experiments in spraying with white oil emulsions against *Pseudococcus citri*.
Hadar, 1937, **10** : 221-3, bibl. 2.
 It was found necessary in Palestine to spray against *Pseudococcus citri* not less than 2 or 3 times from July to September inclusive with 2.5% white oil emulsion in order to obtain effective control.

194. PASCUAL, A. 634.63
Olive-growing in the New World.
Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1937, **28** : 457T-467T.
 A short account is given of the history and present state of the olive growing industry in U.S.A. (chiefly California), Argentina, Chile, Uruguay and Peru. The total number of cultivated olive trees on the American continent is calculated at 3½ million, of which 2½ million are in bearing.

195. DONATO, L. 634.63
L'olivicoltura ed il problema dei grassi vegetali. (**Olive growing and the problem of vegetable oils.**)

Ital. agric., 1937, 74 : 1023-9.

MARINUCCI, M.

I mezzi tecnici per incrementare la produzione dell' olivo. (**Technical measures for increasing olive production.**)

Ibidem, 1937, 74 : 1031-6.

In the first of these articles a census is made of olive production throughout the world and in particular of that in different parts of Italy with notes on production of oil per tree and per province. In the second the factors are discussed which tend to restrict a maximum production of oil from olive trees in Italy and suggestions for their elimination. In the past the olive has merely been allowed to grow and has received practically no attention either in the matter of manuring or pruning. It is suggested that suitable cultivation methods coupled with pruning on such lines as those advised by Tonini or Roventini (*Ibidem*, 1936, 73 : 517-27, *H.A.*, 1936, 6 : 38 and *Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.)*, 1936, 27 : T256-T261, *H.A.*, 1936, 6 : 303) will greatly increase production.

196. ANAGNOSTOPOULOS, P. TH. 634.63-1.55
Irregular fruiting (alternate bearing, etc.) of the olive tree. Causes and means of prevention and control. [Greek, English summary.]

Horticultural Research, Athens, 1937, 2 : 194-225.

The olive bears best on the medium sized twigs owing to their properly balanced C/N ratio. Both ultra strong and weak shoots exhibit severe abscission of flowers. The formation of small or irregular fruits is prevalent when humid atmospheric conditions coincide with the time of flowering. The reasons for this are discussed. The irregular bearing of olives may often be changed to annual bearing by the following treatments. Provision of adequate space (10 metres apart is suggested as a suitable planting distance), cover cropping from October to February when the crop should be ploughed in, occasional light cultivation to control weeds and conserve moisture during the rest of the year, adequate organic and artificial manuring, the elimination of all secondary crops under the trees, the removal of all twigs which have borne a heavy crop the preceding season, and ringing strongly vegetative shoots.

197. KERIMOV, A. 581.192 : 634.64 + 634.63 + 634.55 + 634.574 + 634.37
Biochemical study of the subtropical fruit trees of Azerbaijan. [Russian, English summary 1 p.]

Bull. appl. Bot., Leningrad, 1934, Ser. III, No. 5, pp. 325-48.

In 1932-3 the biochemical laboratory of the East-Caucasian Station of the Institute of Plant Industry carried out analyses of pomegranate, olive, fig, almond and pistachio growing in Azerbaijan. The following notes are taken from the author's summary :—*The pomegranate.* About 30 varieties were tested and great variation in sugar content was found. In the cultivated varieties this varied from 11 to 19%, and in the wild varieties from 12 to 18%, though the sweetness of the latter was found to be mitigated by the presence of a larger acid content in the juice. *The olive.* The accumulation of substances during fruit ripening was studied. The sugar content was found to decrease gradually during ripening, rising again towards the end of the process. The oil percentage increased steadily up to complete ripeness. When the olive was fully ripe, or over ripe, the oil percentage slightly dropped. This fall coincided approximately with the time of the sugar increase. The ash percentage decreased during ripening. The constituents of oil in the process of dynamics were analysed as follows :—As regards the oil the acid ratio dropped up to final ripeness, while the iodine ratio decreased rapidly at first and then rose slightly in the oil of the ripe fruit. *The almond and pistachio.* The oil content of almonds was found to be higher in Apsheron varieties than in those from Crimea, and of pistachios than that of Central Asiatic varieties. *The fig.* Fresh and dried figs from the Apsheron Peninsula and Central Asia are under investigation.

198. CHIKLADZE, V. T., AND VIUNIKOV, F. I. 634.64
Pomegranates in the Mikoyanabad region. [Russian.]
Soviet Subtropics, 1937, No. 11 (39), pp. 83-5.

This paper deals with the treatment of pomegranate bushes common in the Mikoyanabad region. The local method of propagating these bushes vegetatively is interesting. 60-70 cm. long cuttings are bent to the shape of an arch, both ends of which are embedded in the soil to form roots. Thus after strong roots have formed themselves on both ends, two rooted plants are produced by a cut through the middle of the cutting. This method is stated to effect up to 95% take. Names of better known varieties are given and their characteristics described.

199. MILLER, C. D., AND ROBBINS, R. C. 634.651 : 577.16
The nutritive value of papaya.

Biochem. J., 1937, 31 : 1-11, bibl. 26.

1. Papayas (*Carica Papaya*) grown in Hawaii have been analysed for organic nutrients, calcium, phosphorus, iron, chlorine and acid-base balance. 2. Papaya compares favourably with oranges as a source of calcium, basic ash and ascorbic acid. 3. The vitamin C content of papaya increases with ripeness. 4. Average papaya is estimated to contain per 100 g. of edible material, 2,500 international units of vitamin A, 8 international units of vitamin B₁, 70 mg. of ascorbic acid (vitamin C) and 33 Bourquin-Sherman units of vitamin B₂ (G). [Authors' summary.]

200. ANON. 634.653
Avocado (*Persea gratissima*).

Tropenpflanzer, 1938, 41 : 28-34, bibl. 19.

A brief botanical and geographical description is given of the avocado, *Persea gratissima* Gaertn. (*americana* Mill.), and *P. drymifolia* Chamb. and Schlecht. These two include some 400 known varieties. The necessary climatic and soil conditions, approximating to those required by citrus, are discussed. The most important commercial varieties are listed with notes on their cold resistance. Cultivation practice including vegetative propagation, manuring, etc., is described. The chief pests and diseases are noted. Ripening and storage are discussed. Figures are given of the analysis of fruits and seeds and the possibility of obtaining ethereal oils from the rind and the leaves is noted. At present the most important centres of production are California, Florida, West Indies, Mexico and Central America, Hawaii and the Philippines. In addition important plantings exist in Malaya, Java, Ceylon, South Africa, Algeria, Canary Isles, Australia, Polynesia, New Zealand and the South of Spain.

201. HAAS, A. R. C. 634.653 : 581.192
Chemical composition of avocado fruits.

J. agric. Res., 1937, 54 : 669-87, bibl. 13.

The different parts of the fruit of Fuerte, Benik, Puebla, Anaheim and other avocado varieties were submitted to chemical analysis and comparative results are set out in detail.

202. HORNBY, A. J. W., AND CORMACK, A. B. 633.85
The tung-oil or mu-tree in Nyasaland.

Bull. Dep. Agric. Nyasaland, agron. Ser., 4, undated (1937), pp. 11, bibl. 5.

This bulletin deals with the experimental cultivation and propagation of *Aleurites montana* in Nyasaland. In that country *A. montana* is generally suited to an altitude of 2,500-3,500 feet, *A. Fordii* is suited to high elevations with a large summer rainfall and high humidity and, as has been found elsewhere in Africa, will often fail where *montana* succeeds. Localities likely to be suitable to *montana* are discussed. It grows well on a slightly acid, deep, but well drained soil of sandy clay or loam. Soils forming hard pans near the surface are bad. Vegetative methods of propagation had not succeeded with *montana* in Nyasaland when the bulletin was issued. The seeds have a short viability and germinate better and grow more robustly in unshaded beds. Cutting back should not be done on transplanting unless the growing point dies, in which case it is necessary to cut back hard into the living tissue and allow only one bud

to develop. The shape of tree to aim at is a single stem from which the first laterals appear not lower than $2\frac{1}{2}$ feet from ground level with normal branches in whorls appearing every 4 or 5 feet. No other pruning of live wood is advisable as the fruit is produced on the wood of the previous season. The tree should be treated as an orchard crop as regards cultivation. Cover crops may be grown between the rows, especially *Dolichos Hosei* and *Calapagonium mucunoides* which support shade. As the crop is harvested by picking up the fallen fruits after they have been left on the ground for some weeks to dry, the cover crop should be kept from under the branches. A dormant period follows harvest. In Nyasaland *Armillaria* root disease and various scale insects cause loss.

203. KLIMENKO, K. T. 633.85-1.523
Hybridization of tung tree. [Russian.]
Soviet Subtropics, 1937, No. 5 (33), pp. 87-90.

Breeding of new tung tree hybrids, started at the Batum Botanic Garden in 1934, still continues. Parent plants used in the experiments were mainly 25-35-year-old *A. cordata* and 5-year-old *A. Fordii* trees. The following cross-pollinations were made:—*A. Fordii* \times *A. Fordii*, *A. Fordii* \times *A. cordata*, *A. cordata* \times *A. Fordii* and *A. cordata* \times *A. cordata*. The object is to produce plants possessing the short growing period of *A. cordata* and the size of the fruit, the quality of oil and the frost resistance of *A. Fordii*. As a result of the pollinations carried out in 1934-6 2,862 different hybrid seedlings were obtained. There are indications that these hybrids, particularly those obtained from the *A. Fordii* \times *A. cordata* (pollinator) cross will show the expected results on bearing their first crop in 2-3 years' time.

204. LEGROS, J. 633.85
Present state of *Aleurites* cultivation in British Possessions (Colonies, Protectorates, Mandated Territories).
Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1937, 28 : 281T-314T.

This report is a compilation from information supplied by the different Departments of Agriculture in the British Possessions. In most of these countries the cultivation of *Aleurites* is still in the experimental stage, but it is clear that the genus is somewhat exacting as to environment. It has, however, been found that, if *A. Fordii* fails, *A. montana* may succeed and *vice versa*, but even so the countries in which commercial success may be anticipated are in a minority.

205. LEGROS, J. 633.85-1.8
The problem of application of fertilizers in *Aleurites* plantations.
Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1937, 28 : 197T-205T, bibl. 2.

Aleurites will not tolerate a badly drained soil, otherwise its soil preferences do not seem to be marked. Experiments carried out at Gainesville, Florida, of which the results are tabulated, indicate that want of nitrogen is the limiting factor in growth. A suitable fertilizer for young trees is 5% ammonia, 7% phosphoric acid, 2% potash, the percentage of the two latter ingredients being increased when the trees have reached fruiting stage. When possible the nitrogen should be supplied through some organic manure, in particular guano. Experiments carried out to ascertain the effect of fertilizers on the oil content of seeds gave scarcely significant results, although reports from China assert that the oil content is greatly influenced by the degree of richness of the soil.

206. WILLARD, H. F. 634.1/7-2.772-2.96
Parasitization of the Mediterranean fruitfly in Hawaii, 1914-33.
Circ. U.S. Dep. Agric. 439, 1937, pp. 17, bibl. 10.

The amount of infestation by the fruitfly (*Ceratitis capitata*) in Hawaii in the years 1916-33 and the effectiveness of controlling this fly over the period from 1914-33 by *Opius humilis*, *Opius tryoni*, *Opius fullawayi* and *Tetrastichus giffardianus* larvae are recorded here by the Bureau of Entomology, U.S. Dep. Agric. Of the four species *Opius tryoni* proved the most valuable under Hawaiian conditions.

207. NADOLYA, I. K. 633.526.43
Vegetative propagation of Yucca. [Russian.]
Soviet Subtropics, 1937, No. 6 (34), pp. 85-7.
 In this paper *Yucca gloriosa* and its propagation by means of 5-7 cm.-long cuttings are described. Yucca leaves are commonly used in Caucasus for tying up vines. This material is said to be superior in strength to New Zealand flax and to bast.

TROPICAL CROPS.

208. OPSOMER, J. E. 581.084 : 519
 Notes techniques sur la conduite des essais avec plantes annuelles et l'analyse des résultats. (**Notes on the conduct of trials with annuals and the analysis of results.**)
Publ. Inst. nat. Étude agron. Congo Belge, Ser. sci., 14, 1937, pp. 79.
 Descriptions of systematic lay-outs, together with a worked example, are followed by a summary of modern methods and worked examples of randomized blocks with one and two factors, and a latin square, first single and then replicated. Notes follow on the shape, size and orientation of plots and blocks while an appendix deals with the practical aspects of trials on rice, ground nuts and cassava in the Belgian Congo.
 S.C.P.

209. LESTER-SMITH, W. C. 631.459
The conservation of the soil.
Trop. Agriculturist, 1937, 89 : 167-74.
 A discussion of the problem of erosion and its prevention as it affects estate plantations.

210. KEILLER, P. A. 631.459 : 631.841.1
Loss of sulphate of ammonia during rain.
Trop. Agriculturist, 1937, 89 : 127-34.
 As a result of experiments in Ceylon, which are described, it is concluded that the loss of sulphate of ammonia by surface wash during rain, even from unforked and hard soil, is small and quite negligible from land which had been forked six months before application. Light forking in on previously hard land, however, may be harmful, since by increasing the amount of soil washed away it may take a large proportion of the sulphate of ammonia with it.

211. SINGH, B. N., AND SINGH, S. N. 631.874
Decomposition of *Crotalaria juncea* under field conditions.
J. Amer. Soc. Agron., 1937, 29 : 885-9, bibl. in text.
 Within 4 weeks of digging *Crotalaria juncea* into the soil at Benares, India, the major part of the leaves had decomposed and at this period they contributed most to the fertility of the soil in terms of available and total nitrogen. The subsequent rapid decline in nitrogen is attributed to leaching. At the end of 8 weeks, at the time of sowing the succeeding crop, 30% of the total dry weight, mainly roots and stems, was undecomposed. The present method of green manuring with *Crotalaria juncea* in India has therefore serious defects, since a large part of the plant remains unaffected and the nitrogen from the affected parts has disappeared into the subsoil before the succeeding crop is planted. Thus there is a wide difference between the expected and the actual values of green manuring efficiency with this plant.

212. HOWES, F. N. 632.951.1
***Tephrosia macropoda* as a possible insecticidal plant.**
Kew Bull. 1937, No. 10, pp. 510-3, bibl. 3.
 Trials with *Tephrosia macropoda* grown in cultivation in Natal showed the insecticidal properties to be insufficient to compete with *Derris*. Roots harvested after 2 years were a good deal larger and more toxic than year-old roots and larger and less contorted than wild roots of similar age. As with *Derris* the degree of toxicity probably varies from plant to plant, and, similarly, selection may provide strains with increased insecticidal powers. The plants seed easily under cultivation and can be propagated vegetatively.

213. EJERCITO, J. M. 632.951.1

The culture of derris.

Philipp. J. Agric., 1937, 8 : 89-94.

This paper is a Farmers' Circular on the cultivation of derris. It contains no new information.

214. LEGROS, J. 632.951.1

Cultivation of derris in the Far East.

Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1937, 28 : 1T-12T.

The present state is reviewed of the cultivation of *Derris* in Malaya, Borneo, Philippines, and the Dutch East Indies, and is followed by a discussion of the chemical composition of the roots.

215. GEORGI, C. D. V., AND TEIK, G. L. 632.951.1

Further selection experiments with *Derris malaccensis*.

Malay. agric. J., 1938, 26 : 4-17, bibl. 4.

A study is made of the 3 varieties of *Derris malaccensis* grown in Malaya with the object of eventually developing strains of plants with roots of high toxic content and so eliminating as far as possible the variability in quality of commercial consignments of root. In a previous paper (*Ibidem*, 25 : 187-200, *H.A.*, 1937, 7 : 737) varieties of *D. elliptica* were discussed.

216. GEORGI, C. D. V. 632.951.1 : 631.56

A new method of harvesting, drying and sampling derris root.

Malay. agric. J., 1937, 25 : 425-9.

Harvesting. No effort was made to preserve the roots intact. The stems were cut off at ground level, the roots being forked up and placed in baskets and removed to a sorting shed where they were roughly cleaned and all portions of stem removed. The marketable roots, i.e. up to $\frac{1}{2}$ inch diameter, were chopped into 6-inch lengths and sorted into two grades, fine and very fine.

Drying. The two grades were separately dried on a kiln similar to a hot-table copra kiln, the average temperature was 140° F., and drying was complete in 3 days. During the turning on the drying kiln any adhering earth fell away. *Sampling* at random a wide degree of variance in toxic content may be formed between any two groups of 20 bales, and this variance, though less than that between plant and plant, is too wide to admit of reliance being placed on any single random sample. For this reason a definite sampling procedure should be arranged between buyer and seller preferably as to the amount to be drawn from each bale when the root is being pressed. Advantages of chopped roots are the complete absence of dust detrimental to the health of the labourers and the reduction of stem, important in view of the fact that the presence of stem has an adverse effect on the price. The alleged liability of chopped root (or of powdered root) to deteriorate in storage was not confirmed in the experiment carried out by the Department of Agriculture.

217. MILSUM, J. N. 632.951.1

***Derris uliginosa*.**

Malay. agric. J., 1938, 26 : 18-9, bibl. 4.

It is noted that the correct name for *Derris uliginosa* Benth. is now *D. trifoliata* Lour. It is a common plant in certain localities in Malaya. Plants have now been on trial at the Serdang experiment station and have been found to possess insufficient toxicity to be of any commercial value.

218. GEHLSEN, C. A. 633.5

Die Faserpflanze "Caroá". (The fibre plant "Caroá".)

Tropenpflanzer, 1937, 40 : 444-7.

The difficulty with Caroá (*Neoglaziovia variegata*) (*Bromeliaceae*), which grows in the coast States of Brazil and would appear to offer certain advantages over jute as a source of fibre, lies in its propagation. Hitherto attempts to propagate from rhizomes had failed and seed viability also appeared to be feeble. The seed trials here described were made by the author at the Instituto

de Pesquisas Agronomicas, Recife, Brazil. No great difficulty was experienced in getting the seeds to germinate, but in order to eliminate poor germination followed by high mortality in seedlings due to *Aspergillus* and *Penicillium*, it was found expedient to pickle the seed previously for 5 to 10 minutes in strong sulphuric acid of 65/66° Bé. Attempts to facilitate and accelerate germination by filing the seed coat were unsuccessful, but pouring hot water at 80° C. over the seeds in a vessel and allowing to cool did shorten the time necessary for the germination of all viable seeds.

219. CRUZ, E. E. 633.526.23

A study of different species of *Agave*.

Philipp. J. Agric., 1937, 8 : 1-6, bibl. 2.

Five species of *Agave* growing in the Philippines are discussed from the standpoint of their economic possibilities. Of these *A. cantala* and *A. sisalana* proved decidedly the best, the others examined being *A. fourcroydes*, *A. zapupe* and an unidentified species. In all varieties it was found that an increased rainfall was followed by increased yield. Retting produced a much greater amount of fibre than knife stripping.

220. JIMINEZ, P. G. 631.535 : 633.513 + 633.863.9 + 634.65/66

Callus and root formations in stem cuttings of kapok, achiote and santol.

Philipp. Agric., 1937, 26 : 585-610, bibl. 14.

The plants named in the title are *Ceiba pentandra*, *Bixa orellana* and *Sandoricum koetjape* respectively. Cuttings of various lengths and of various stages of growth were used. Suberization took place in the parenchymatous cells of cortex, phloem and pith and became evident (on application of the Sudan III test) in 20.5, 27 and 16 hours for each of the respective species. The rate of callus formation was in the order *Ceiba*, *Sandoricum* and *Bixa*. In *Sandoricum* the callus development was mainly in the cambial region, in *Bixa* in the bark and in *Ceiba* in both. In *Ceiba* and *Sandoricum* root formation occurred on the wound callus at the basal end, seeming to originate from the newly formed phellogen below the suberized layer. In *Bixa* adventitious roots were formed either from the callus or from preformed roots which emerged through the lenticels. In *Ceiba* the most successful cuttings were made from year-old half-ripened green wood. With *Bixa* hardwood cuttings proved best. *Sandoricum* cuttings proved difficult in any form and rooting was only obtained by using cuttings from branches which had been girdled at least 42 days beforehand and then only from cuttings situated immediately above the girdle. In all cases setting the cuttings in beds in the open air under shade gave better results than setting in sand with bottom heat in the laboratory.

221. PARK, M., AND FERNANDO, M. 633.71-2.4

Some studies of tobacco diseases in Ceylon. I and II.

Trop. Agriculturist, 1937, 88 : 153-68, bibl. 4, and 266-82, bibl. 6.

In the first paper the results are recorded of an investigation of the damping off of seedlings (*Pythium* sp.) and frog-eye or eye spot attack (*Cercospora Nicotianae* E. and E.). The spraying of seedlings weekly in the nurseries controlled damping off and reduced the initial infection of *Cercospora* after transplanting. The main source of infection by the latter appears to be the soil. The second paper shows that a single field spraying of tobacco at the time of topping reduced markedly the amount of frog-eye infection, resulted in an increased crop and reduced the amount of barn spot on the cured leaf. Earlier or later sprayings were inefficient. In both papers the spray referred to is 1 oz. Bouisol colloidal copper, $\frac{1}{16}$ oz. Agral 2, 1 gall. water.

222. WELLENSIEK, S. J. 633.72-1.52

Grondslagen der theeselectie. (**Principles of tea selection.**) [English summary.]

Landbouwkundig Tijdschrift, 1937, 49 : 337-47.

The ultimate purpose of tea selection is to obtain as large a difference as possible in favour of the grower between the cost of production and the selling price. The steps by which this is attempted are:—(1) nursery selection of the plants of strongest vegetative habit judged by measurement of stem diameter of very young seedlings or by separating out seeds of large diameter and high

specific gravity ; (2) selection of seed parent. A preliminary selection by eye is first made for rapid growth after pruning, large plucking surface and high density of shoots. Individual yield determinations are then made on these selections, the criterion being a yield of at least three times the average for the garden ; (3) vegetative propagation of selected trees by budding ; good stocks are obtainable by nursery selection [a method of generative propagation and hybridization is also needed and is being worked out in Java] ; (4) field tests of resulting clonal progeny using R. A. Fisher's principles of analysis ; (5) establishment of selected plucking gardens from clonal selection ; (6) establishment of selected seed gardens from a combination of selected clones ; (7) the field testing of the selected seedlings of (6). The author expects that a recrudescence of generative selection will succeed the present cycle of clonal selection and vegetative propagation which began in 1932.

223. WELLENSIEK, S. J. 633.72
 Reisindrukken over theeselectie en-cultuur, 1937. (Travel impressions on tea selection and culture, 1937.) [English summary.]
Arch. Theecult. Ned. Ind., 1937, 11 : 201-59, bibl. 33.

The author reports on visits to the tea growing districts and research centres of India, Ceylon and Japan. Comparing the Tea Research Stations in India and Ceylon with those of Java he notes the following differences. The British organization is simpler and interest is concentrated wholly on tea ; research stations are situated in the centre of tea districts but are remote from direct contact with other scientific institutions ; in Assam and Ceylon extensive experimental fields are in use and an experimental factory ; no experiments, as a rule, are carried out on private estates in conjunction with planters. The fundamental nature of the work does not differ from that of Java. Differences in cultural practices in India and Ceylon to those in Java are :—In Assam 1-year-old plants are transplanted from the nursery without cutting back ; in all districts fine plucking is practised ; in S. India (Devarshole) a pruning cycle of one year for every 1,000 feet above sea level is advocated ; in all research stations complicated field experiments are in progress on the principles laid down by R. A. Fisher ; the effect of cultural measures on quality as well as on yield receives much attention. In Japan the hedge system of planting is used exclusively. The various types of tea under cultivation are then discussed. In Assam nursery selection is used in laying out seed gardens and in Japan in laying out the plucking gardens. Rapid germination of seed is in Japan considered of importance. It is desirable that the advance to clonal selection as opposed to parent seed tree selection should be achieved as soon as possible. Budding however is not yet practised, attention being centred on propagation by cuttings, in which little success can be recorded. Quality is influenced by altitude, climate, season and system of plucking ; soil and manuring have little influence.

224. ZALDASTANISHVILI, SH. G. 633.72 : 576.312.32
 On the chromosomes of the tea plant, *Camellia sinensis* (L.) O. Ktze. [Russian, English translation.]
Bull. appl. Bot., Leningr., 1932, Ser. II, No. 1, pp. 242-50, bibl. 3.

The writer states that the only data previously available on *Camellia sinensis* chromosomes are those given by Stuart in *Annales du jardin botanique de Buitenzorg*, 1918, in an article entitled "Sur le developpement des cellules génératrices de *C. théifera*". The present article is a preliminary report on cytological investigations made with seed of a so-called Chinese variety sent from Ozurget, the chromosomes being studied in nuclear plates of rootlet meristem from seeds grown in sand. A good English translation of the text is given.

225. DE HAAN, IX. 633.72 : 581.145.1
 De bloeiwijze en de bloem van *Thea sinensis* var. *assamica*. (The inflorescence and flower of *Thea sinensis* var. *assamica*.) [Short English summary.]
Arch. Theecult. Ned. Ind., 1937, 11 : 280-91, bibl. 4.

The inflorescence and flower of *Thea sinensis* var. *assamica* is described. It was found that the average number of stamens and also the sum of calyx and corolla leaves can be used as descriptive characteristics of clones.

226. KANTARIA, E. N. 633.72 : 581.192

Variability of tannins and caffeine in tea leaves. [Russian.]
Soviet Subtropics, 1937, No. 8 (36), pp. 74-6.

An account of the experiments conducted in 1935 by the U.S.S.R. Institute of Tea Culture. Tea leaves picked during different periods of the growing season and at different times of the day were analysed, leaves of four bushes of different varieties being used in the experiment. For analysis of tannins the Eder method was used; the caffeine contents were determined by the S. Keller method. The author reached the following conclusions:—1. Tea leaves picked in the morning are the best. They contain more of the tannins than those picked at mid-day. The amount of tannins in the evening-picked leaves is almost equal to that of leaves picked in the morning, but the former contain more starch. It has not been established yet as to what extent starch affects the quality of tea, and it is, therefore, difficult to discuss the technological value of leaves picked in the evening hours. 2. During the first stages of the growing period, tea leaves contain smaller quantities of tannins than later. The third leaf containing only a poor quantity of tannins, only two-leaved shoots should be picked for high quality tea. The report is tabulated.

227. DZHANASHIA, A. A. 633.72-1.517

Depth of soil cultivation for tea. [Russian.]
Soviet Subtropics, 1937, No. 3 (31), pp. 67-72.

Experiments were carried out by the U.S.S.R. Institute of Tea Culture to find the optimum depth and the best way of cultivating soils for planting tea shrubs. The author describes his own experiments made on podzol soil in Zugdidi and on light-podzol soil in Zvan. The roots were measured both by weighing and by the frame method. The number of plants used in the experiment is not stated. The following conclusions are reached:—Deep cultivation of soils and equal distribution of humus develop strong and normal roots. Plants growing on deeply cultivated soils produce more leaves than others. Data received by the Institute indicate that tea plants growing in soil cultivated 54 cm. deep produce a 20-25% higher yield than those in soil cultivated 27 cm. deep only. The author's own data show a difference of 15-25%. Deep cultivation should take place in winter or in early spring, as during the growing period the root system might be damaged. In case of shallow cultivation only 20% active roots of the total root weight develop in the soils 30-60 cm. deep, as compared with 30% in deeply cultivated soil. The greatest number of active roots are formed in soil layers rich in humus.

228. MEPPEN, D. 633.73

Coffee.
J. Mysore agric. exp. Un., (undated), 17 : 1-13.

A short history of the origin and progress of the Mysore coffee industry.

229. LEGROS, J. 633.73

Coffee production in the French Possessions (Colonies and Mandated Territories).
Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1937, 28 : 149-70, bibl. 11.

A detailed survey of the methods and extent of coffee growing in the French Possessions. The actual and estimated production both native and European for 1935 and 1940 are separately tabulated and the yield shown for 5 varieties and for each country.

230. BALLY, W. 633.73

Recent efforts for the improvement of Brazilian coffee.
Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1937, 28 : 13T-21T, bibl. in text.

The problems discussed are an improvement on the primitive method of picking by stripping and in the methods of preparation of the coffee bean after harvest. The necessity of shade to prolong ripening and so to prevent the berries from drying on the trees is urged. A method of improving quality while waiting for the shade trees to grow was needed and this, it is hoped, has been found by spraying the berries with yeasts. Preliminary trials have been successful in

eliminating the harsh taste. The nature of the action of the yeasts is attributed to secretion of a ferment which penetrates the beans and provokes the mild flavour or to the secretion of a chemical composition which inhibits the activities of other organisms responsible for the "Rio flavour".

231. GILBERT, S. M. 633.73 : 581.084.2

Plot size in field experiments with *Coffea arabica*.

Trop. Agriculture, Trin., 1938, 15 : 52-5, bibl. 5.

From uniformity trials, which are here described, it was determined that 20 trees per plot appeared to be a suitable number for field experiments with seed-grown *arabica* coffee in Tanganyika. With young and irregular coffee three years natural yield are desirable while with older and more even blocks two years may be enough.

232. MORSTATT, H. 633.73-2.3 + 2.4 + 2.6 / 7

Kaffee-Schädlinge und -Krankheiten Afrikas. (**Pests and diseases of coffee in Africa.**)

Tropenflanzer, 1937, 40 : 47-65.

The author here concludes his series of articles on coffee pests and diseases continued from *Ibidem* 38 : 413, 39 : 91, 273 and 455, *H.A.*, 1935, 5 : 696 and 1937, 7 : 195. He here deals with common root injuries caused by insects, eelworms, fungi and bacteria, and with the various sources of danger to coffee seed beds, seedlings and young trees.

233. FERWERDA, F. P. 633.73 : 581.145.2

Nadere gegevens over het optreden van onvolkomen ontwikkelde boonen bij koffie. (**Further data on defective beans in coffee.**) [English summary.]

Arch. Koffiecult. Ned. Ind., 1937, 11 : 119-34.

There are two types of abnormal beans in coffee, the wholly and the partly defective. The wholly defective beans result from an early abortion of the embryo and a failure to develop of the surrounding tissues, leaving only a parchment-like scale. The accompanying bean in these cases is nearly always round. In partly defective beans the embryo develops normally but the endosperm is deficient in various degrees. The partly defective beans are found only in hybrids, the wholly defective in species and hybrids alike. The loss from these beans may amount to 40%. A low fruit set (cross and self-incompatibility) is associated with a high percentage of defective seed in *robusta* and *congusta* coffee, but in hybrids no such association can be traced for either wholly or partly defective seed.

234. FAULKNER, O. T., AND MILSUM, J. N. 633.74-1.543.1

Cacao.

Malay. agric. J., 1938, 26 : 20-6, bibl. 9.

The possibilities of cacao cultivation in Malaya are discussed and instructions given for the treatment of plantations under local conditions. It is probable that the failure of previous experimental plantings over a number of years has been due to failure to supply the tree with the degree of shade which is necessary to it at least in its early years. *Gliricidia maculata* is the most suitable shade tree.

235. POUND, F. J. 633.81

History and cultivation of the tonka bean (*Dipteryx odorata*), with analyses of Trinidad, Venezuelan and Brazilian samples.

Trop. Agriculture, Trin., 1938, 15 : 4-9, 28-32.

The local methods of growing tonka beans in Trinidad are described and suggestions made for improvement. The fact that the tonka bean will grow on poor soils has given the impression that it needs the minimum care. It is shown that on the contrary the tree responds very considerably to proper cultivation. Though usually grown from seed the tree can be propagated by means of budding, grafting and marcotting, while the rooting of cuttings is possible if not at present easy. The commercial uses of the bean are mainly in the perfumery and confectionery

trades, though the U.S.A. take a large proportion of the crop for flavouring tobacco. A note is given of the curing process, which consists largely of soaking in rum of 45 to 65% alcohol content by volume. Although from the reports of trade analyses on samples submitted by the Department of Agriculture it might be thought that the Brazilian beans would be more valuable than the Trinidad and Venezuelan beans (cured in Trinidad), actually they command only $\frac{1}{2}$ to $\frac{1}{3}$ the market value.

236. PARK, M. 633.825-1.521.5

Seed treatment of ginger.

Trop. Agriculturist, 1937, **89** : 3-7, bibl. 4.

Seed ginger superficially infected with *Sclerotium Roflsii* was treated by immersion in a 1 : 1200 aqueous solution of corrosive sublimate for 1½ hours 2 months before planting and (another batch) 3 days before planting. Though the crop subsequently failed through drought, judging by the number of plants which developed compared to the controls, the treatment was markedly beneficial. There was no significant difference in results between early or late treatment.

237. PAUL, W. R. C., GUNERATNAM, S. C., AND CHELVANAYAGAM, A. V.

633.841

The betel vine in the Northern Province.

Trop. Agriculturist, 1937, **89** : 281-98.

An account of the specialized cultivation in the Northern Province of Ceylon of the betel vine (*Piper Betle L.*). Suggestions are made for possible improvements leading to an increased yield.

238. PAUL, W. R. C. 633.842

Chillies.

Trop. Agriculturist, 1937, **89** : 154-9, reprinted as *Leaf. Dep. Agric. Ceylon* **112**.

Instructions are given for the cultivation and curing of dry chillies suitable for the dry zones of Ceylon. The normal yield is from 500-1,200 lb. per acre, which could be raised to 2,500 lb. with intensive cultivation and high-yielding strains.

239. OBERDOERFFER, M. J. 633.88

Heilpflanzen aus der Volksmedizin Nigerias. (*Nigeria's officinal plants.*)

Tropenpflanzen, 1938, **41** : 20-7, bibl. 2.

A description of medicinal plants commonly used in Nigeria for internal and external purposes by native witch doctors and others, with notes on their uses.

240. OZEROV, G. 633.88-1.8

Chinchona tree as affected by fertilizers and stimulants. [Russian.]

Soviet Subtropics 1937, No. **12** (40), pp. 79-81.

This is a preliminary report of three separate trials made with *Cinchona succirubra* plants by the author in the Sukhum nursery in 1936. Fertilizers used in the experiments were ammonium nitrate, primary potassium phosphate, calcium sulphate, magnesium sulphate and potassium nitrate. A trial was also made of giving potassium permanganate and sulphates of manganese and zinc as stimulants. The data so far available from 3 trials are tabulated but do not afford grounds for definite conclusions or recommendations.

241. SCHMÖLE, J. F. 633.912-1.543

Voorloopige resultaten van een plantverbandproef met oculaties. (**Planting density trials with budded rubber.**) [English summary.]

Arch. Rubbert. Ned. Ind., 1937, **21** : 37-53, being *Meded. alg. Proefst. A.V.R.O.S. Rubber. Ser.* **102**.

The results are reported for the first 9 years of an experiment (8 replications) on planting densities using budded rubber. Normal selective thinning was not practised except that backward trees untappable at 9 years of age were removed from the plots of 450 and 250 trees per acre (planting distance 3×3 and 4×4 m.). After the third year girth increased more rapidly in

the wider spaced plots. The maximum number of tappable trees for each stand was as follows :— spacing per acre 450=300, 250=200, 160=147, 113=103 and 83=77. The denser plantings at first gave considerably the higher yields, but the differences soon decreased as the trees became older. In the fifth tapping year the difference in yield per acre between the 450 per acre and the 113 per acre plots amounted to 100 lb. or 32%, and in the ninth year to 163 lb. per acre or 18% of the yield of the wide planted plots. It is argued that, if by selectively thinning say 200 trees down to 100 trees per acre the average yield is raised by 15%, then a planting of 100 trees per acre should after the third year of tapping yield not less than an unthinned planting of 400 trees per acre with, of course, a lowering of costs. The dry rubber content of latex is higher in the wider spacings, and the bark renewal is more efficient.

242. O'BRIEN, T. E. H. 631.459 : 633.912

Soil erosion in relation to rubber estates.

Quart. Circ. Rubber Res. Sch. Ceylon, 1937, 14 : pp. 62-70.

The methods of preventing soil erosion in mature rubber areas and in young clearings are considered. Under mature trees any kind of cover is better than none, but grass in general is not desirable because of its powers of competition with the tree roots. Desirable types of natural cover are erect shade-tolerant species with large succulent leaves and deep rooting habit. Undesirable varieties are those with foliage resistant to decomposition such as most grasses and ferns with a tufty root habit. A leguminous cover should be established when possible. Methods are touched on for improving existing drainage systems so as to retain a maximum proportion of rainfall on the land and ensure a minimum erosive action from the surplus. In replanting on newly cleared areas the earthworks are constructed in advance. It is questionable whether in areas of heavy rainfall it is desirable to prevent all run-off of water from the land, since the percolation through the soil to lower levels may result in leaching of soil nutrients. Three methods of opening, namely contour platforms, contour trenches and contour drains, are compared. For cover crops a mixture of creeping and erect types should be sown such as *Calopogonium mucunoides*, *Centrosema pubescens*, *Crotalaria anagyroides*, *Tephrosia candida* and *T. Vogelii*. *Pueraria phaseoloides* is not recommended with young rubber though useful under mature trees. The creepers eventually swamp the erect forms whose use is the provision of a temporary cover while the creepers are growing. *Gliricidia maculata* provides a useful source of green loppings and *Albizia moluccana* is a useful windbreak.

243. BERTRAND, H. W. R., AND MINOR, E. C. K. 633.912-2.4 : 581.144.2

A method of controlling *Fomes* and other root diseases in replanted rubber areas.

Trop. Agriculturist, 1937, 89 : 135-40, bibl. 1.

A plan for the economical detection of root diseases of *Hevea* by using as cover crops a mixture of *Crotalaria anagyroides*, *Tephrosia Vogelii* and *Boga medeloa* plants which are susceptible to the diseases and will indicate their presence by change of colour. As soon as the disease is indicated suitable action can be taken to sterilize the infected area.

244. PAVLOV, N. V. 633.913

Rubber plants of the West Thian-Schan. [Russian, German summary 1½ pp.]

Bull. app. Bot., Leningr., 1937, Ser. I, No. 2, pp. 255-302.

Studies were made in the mountainous southern part of the Syr-Dariya Province, during one of the scientific expeditions conducted in 1931 by the U.S.S.R. Rubber Research Institute. 101 plants were analysed, and in 40 of them the presence of rubber was established. The history of the investigation and the geology of this mountain-block as well as its flora and climate are described. A systematic list of rubber plants is given. This includes 8 new varieties :— *Euphorbia Korovini* N. Pav., *Lepidolopha caratavica* N. Pav., *Tragopogon marginatum* N. Pav., *T. turkestanicum* S. Nik., *T. Vvedenskyi* M. Pop., *Scorzonera inconspicua* S. Lipschitz, *Lactuca prenanthes mira* N. Pav., *Crepis distincta* M. Pop. et Vved. A description of these plants is given elsewhere. No plants were found to contain sufficient quantities of rubber for industrial purposes. The following notes are from the author's summary : 1. With the exception of the

Liguliflorae, a sub-order of the *Compositae*, the plants classified in the U.S.S.R.'s systematic groups of flora only very rarely contain rubber in their sap. 2. No direct relation exists between the quantity of the chyle and the rubber content of a plant. 3. Observations on the seasonal dynamics of the rubber content in plants indicated that rubber is not a residuary product but is closely connected with the vital functions of the plant. 4. The *Compositae* possessed the most forms containing rubber. The *Euphorbiaceae* and *Apocynaceae* came next. Rubber content in the *Campanulaceae* varied greatly. Of the *Umbelliferae* only one plant contained rubber. 5. The rubber content in this mountain district was generally speaking found to decrease with altitude, but was at the same time dependent also on the xerophytic and mesophytic zones in which the plants lived. 6. Comment is made of rubber plants characteristic for either Boroldai mountains or Talass Alatau, *Scorzonera Tau-saghyz* found in the latter being especially noted.

245. LEGROS, J. 633.913
Secondary rubber yielding plants of the Caucasus region and of Central Asia.

Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1937, 28 : 468T-81T, bibl. 11.

Of the 130 subtropical and temperate plant species which have been investigated in U.S.S.R. for their rubber producing possibilities the most promising so far are guayule (*Parthenium argentatum*), *Eucommia ulmoides*, *Solidago*, varieties of *Scorzonera* (*Tau-saghyz*) and *Taraxacum*, *Apocynum venetum*, *Asclepias Cornutii* and *Chondrilla* spp. *Guayule*. Two pure lines have been obtained from *P. angustifolium* and *P. argentatum* yielding about 100 kg. of rubber per hectare, though 50 kg. is more usual. By subjecting the plants to a special pre-wintering treatment they have been enabled to resist a temperature of -20° C., otherwise -15° C. is their utmost limit of endurance. Arid and subtropical regions are the most suitable. Strains of high rubber yield having been acquired attention is now directed to the development of large size bushes. The highest yield is obtained from 2-year-old plants. Rubber is found in all parts of the plant but principally in the roots. There is a negative correlation between yield in rubber and germination of seeds. *Eucommia ulmoides* is a tree indigenous to C. and W. China extending to the Ukraine. It yields gutta from all parts, especially the leaves, up to $3\frac{1}{2}$ % or 360 kg. per hectare. Plants obtained from seed are always female, so that vegetative propagation has to be used, various methods (cuttings, layers, grafting) being successful. In cultivation experiments red soil proved more successful than alluvial soils and increased moisture, while stimulating growth, reduced the yield of gutta. *Solidago*. The two varieties commonly used in U.S.S.R. are *S. Leavenworthii* and *S. serotina*, of which the second variety has the higher rubber content. The rubber is localized in the parenchymatous tissues of the leaf and in certain isolated areas and is chiefly produced during the ripening of the seeds, the older leaves being the most productive. Studies with this plant are still in the experimental stage. *Scorzonera Tau-saghyz* is a small shrub found at an altitude of 1,000-1,800 m. in Central Asia where the climate is extreme (-35° C. to $+40^{\circ}$ C.). An area of about 20,000 km. carrying 14 million plants is already under cultivation. The shrub reacts favourably to changes of climate and its widespread cultivation will be possible. The rubber is situated in the roots and may reach 35-38%. It is easily extracted by gravitation from powdered roots soaked in water. In the same way the rubber is extracted from the roots of *Taraxacum* (specific names not given) from which a yield of 0.15 to 0.20 tons per acre is expected. *Apocynum venetum* is a perennial native of Caucasian regions. The stems are harvested twice yearly beginning in the third year. The rubber is produced in the leaves and may be from 0.5 to 8.5% with an annual yield of 4 to 5 tons per hectare. The woody stems have industrial uses as construction and isolation material and as a source of furfural. *Asclepias Cornutii*, a North American plant originally imported for use in textile manufacture and discarded, possesses a poor quality rubber in the tissues of leaves and ovules to the extent of 2 to 10%. *Chondrilla* spp. are herbaceous perennials of the Caucasus and Crimea. The rubber is localized in the roots. These were the first rubber yielding plants to be studied by the Soviet Government, but they are not likely to prove superior to those already mentioned. An expedition to the Caucasus in 1931 to search for rubber yielding plants obtained the highest yields from the roots of *Jurinea Levieri*, *Euonymous europea* and the leaves of *Senecio Doria* var. *macrophyllus* and *S. nemorensis*.

246. DORASAMI, L. S. (MYSORE).

634.1/8

Fruit research scheme in Mysore.

Published at Govt. Gardens, Mysore, 1937 (?), pp. 10.

The programme of research at the new fruit research station, Mysore State, is announced. This consists of rootstock trials with apples on imported stocks, varietal trials, manurial trials, irrigation, pollination and thinning experiments. Experiments with pineapples will consist of manurial and spacing trials and about 18 varieties of hardy and subtropical fruit trees will be grown.

247. HODGSON, R. W.

634.1/8

The fruit growing possibilities of Patiala State, India.

Printed in U.S.A. for H.H. Govt. Patiala State, India, 1937, pp. 52.

The basic environmental factors of climate, moisture supply and soil are appraised and the existence of natural fruitgrowing regions in Patiala State is indicated. Recommendations are made concerning the fruits and varieties that appear to be best adapted to the different regions, of which the most promising are the warm temperate zone of the Hills Circle and the arid semi-tropical region of the upper plains. Advice is given on the best method of demonstrating the fruitgrowing possibilities of the State.

248. PAUL, W. R. C., AND GUNERATNAM, S. C.

634.441-1.541.5

The propagation of the mango in Jaffna. II.*Trop. Agriculturist*, 1937, 88 : 331-7.

The first part of this paper described a special method of budding the mango (*Ibidem*, pp. 86-91, *H.A.*, 1937, 7 : 756). The present article deals with the preparation of budding tape, potting, rootstocks and the selection of budwood. Points of interest in potting are the severance *in situ* of the tap root of the budded plant a week before potting or transplanting and the use as pots of plain zinc sheets rolled into cylinder form 4 inches in diameter and held by dovetailed joints strengthened at top and bottom by a girdle of coir string. A porous bottom to the pot is contrived by compacting a small quantity of red loam at the bottom of the pot. When transplanting, the pot and its contents are placed in the ground after loosening the string, the soil is filled in, and the loosened cylinder gently drawn out. The cost of each pot is 12 cents, but they are practically indestructible. Budded plants which have had their tap roots cut before transplanting bear earlier than those budded in the permanent positions. Dormant planting is advised, but, if a flush is in progress at the time, it should be pruned off. As far as information on stocks is available it seems that the sour types of *Mangifera indica* are the most suitable and plants on them require less attention as regards manuring and watering than those on the better varieties. *M. zeylandica* is less promising as a stock than was at first thought. Budwood should be selected from current season's growth showing a pale green colour and smooth surface, the flush being not less than a month old. The characters on which a parent tree should be selected are high and regular yield, good disease resistance, and large, small-stoned, well-flavoured and coloured fruits having firm pulp and a minimum of fibre.

249. AGATI, A.

634.441 : 581.13

The rate of photosynthesis of carabao mango leaves (*Mangifera indica* L.) under field conditions.*Philipp. J. Agric.*, 1937, 8 : 121-44, bibl. 24.

The photosynthesis rate of mango leaves was found to vary, as with other plants, continuously. The young leaves showed no or very low photosynthetic activity while they were in the purple stage which lasted 15 days. From then on (light green stage) for 3 months there was great activity which later diminished to a low point (dark green stage). The maximum rates of assimilation were recorded during the morning and the fluctuations reflected the predominating external factors. It is suggested in conclusion that experiments should be made to decide the influence, if any, of greater or less photosynthesis, i.e. the time of year and the age of the main part of the foliage on such cultural operations as pruning, spraying or manuring.

250. BAKER, R. E. D. 634.441-2.48
Notes on the control of mango anthracnose (*Colletotrichum gloeosporioides*).
Trop. Agriculture, Trin., 1938, 15 : 12-4, bibl. 3.

Mango trees sprayed weekly with 1% burgundy mixture from blossoming until harvest, i.e. from January to July in Trinidad, produced fruit almost entirely free from anthracnose while the unsprayed control fruits were badly affected and became unsaleable almost immediately after picking. Such a spraying programme is of course uneconomic and tests are now in progress to ascertain the minimum number of sprays necessary to obtain control.

251. GALANG, F. G., AND LAZO, F. D. 634.441-1.55 : 632.951
The setting of carabao mango fruits as affected by certain sprays.
Philipp. J. Agric., 1937, 8 : 187-210.

In experiments conducted on the Carabao mango (*Mangifera indica* var.) in the Philippines, calcium arsenate at a concentration of 5 to 9 level teaspoonsfuls for every petroleum canful of water produced a burning effect on the open florets. Lime sulphur at 7 teaspoonsfuls to 5 gallons of water gave the highest percentage of setting. Four teaspoonsfuls of Black Leaf "40" added to 5 gallons of soap solution, prepared by dissolving 40 grains of chip soap in a petroleum canful of water, gave the next highest percentage of setting. The section treated with Fungi-bordo gave a lower percentage than the controls, as did spraying with rain water and tap water. The paper also contains a study of the behaviour of the flowers and panicles during florescence.

252. SMITH, E. H. G., AND TOOVEY, F. W. 634.6
Investigation and selection in the oil palm.
Trop. Agriculture, 1938, 15 : 33-41, bibl. 24.

The oil palm (*Elaeis guineensis* Jacq) and its fruit are described. Oil palms are classified exclusively on fruit appearance, being divided into types on external and forms on internal characters. The types, which are described, are known as ordinary type, mantled type, greenfruited type, mantled greenfruited type. The forms are known as thin-shelled and thick-shelled. Internal form is quite independent of external type. In Nigeria attention has been paid to the production of improved oil palm seed for the farmer. The plots producing these seeds are independent of the experiment plots and are carefully rogued. Ordinary thick-shelled forms appear; they yield 25% more per acre than ordinary thin-shelled; data for other types are not available. A rapid method of fruit analysis has been devised which will determine fairly accurately the percentage of mesocarp, fibre, shell and kernel present in large samples of fruit and can be worked by African assistants. A note is given of a number of modifications in the method of artificial pollination. Records are taken on a number of palms of varying age of date of opening of each new leaf and of each new inflorescence, sex of inflorescence, date of maturing of ripe bunch, weight of bunch and weight and numbers of fertile and unfertile fruits which it contains. Seed germination has been improved by germinating the seed under constantly warm conditions, which are obtained by lighting fires at night under the galvanized iron seed trays. The trays are already raised off the ground on legs as a satisfactory protection against ants. Other types of germinator in the form of covered concrete frames under which fires can be lighted have also been successful. Other methods of obtaining increased germination, e.g. in an artificial smoke-house are mentioned.

253. GREIG, J. L. 634.6-2.51
Epiphytes on oil palms.
Malay. agric. J., 1937, 25 : 448-52.

In an experiment on a block of 439 oil palms the presence of epiphytic growths on the stems has not over a period of 43 months significantly affected the yield or increased the amount of stem rot in the area.

254. STEINLE, J. V., AND JOHNSON, S. C. 634.6-1.556.9

Carnauba wax.

Trop. Agriculturist, 1937, **88** : 297-303, reprinted from *Industr. Engng Chem.*, 1936, Vol. **28**, No. 9.

An account of an expedition to the States of Ceara and Piauhy, Brazil, to investigate the origin and mode of preparation of carnauba wax, a product of the palm *Corypha cerifera*. While this palm can grow in any part of the tropics it apparently only fully develops the waxy coating of the leaves from which wax of commerce is obtained in these particular areas, which are characterized climatically by a few consecutive weeks of heavy rains and floods followed by a fairly complete aridity for the remainder of the year. The development of the heavy wax coating over blossoms, leaves, and fruit reduces evaporation. The primitive methods of preparation, chiefly by scraping cut leaves taken from palms not less than 10 years old, are described. The wax, of which the annual production is 10,000 tons, is of importance in the manufacture of polishes and in a variety of moulded products.

255. TORRES, J. P. 634.61

Some notes on the makapuno coconut and its inheritance.

Philipp. J. Agric., 1937, **8** : 27-37.

The makapuno is a special type of coconut grown in the Philippines in which the meat, of a different type to that in the ordinary nut, almost fills the cavity of the shell. The nut fails to germinate when sown possibly on account of the lack of milk. It commands a high price on the market, 15 to 20 times that of ordinary nuts. From genetical studies it is clear that the makapuno character is due to a single recessive factor, the makapuno-bearing trees being heterozygous. The proportion of makapuno nuts to a palm is reduced by cross-pollination from normal palms. To increase production of these makapuno nuts it is suggested that plantings of selected normal nuts from makapuno palms should be in groups of two or three with subsequent elimination of normal individuals when in bearing. It should be possible to obtain 1,000 makapuno-bearing trees from every 1,500 seedlings raised from carefully selected makapuno-bearing trees. The makapuno nut can be recognized by the characteristic dull sound when tapped or by the fact that there is no sound when shaken.

256. PIERIS, W. V. D. 634.61-1.521

I. Seed selection of coconuts. II. Nursery management and selection of seedlings.

Trop. Agriculturist, 1937, **88** : 216-24, being *Leafl. 1 and 2 Coconut Res. Scheme, Ceylon*.

I. Selection for propagation on coconut estates should consist of selection of (a) mother palms, (b) of seed nuts. In palm selection the characteristics sought should be a straight, stout trunk with leaf scars close together and short, evenly dispersed fronds; the bunch stalks should be short and show no tendency to droop, the inflorescences uncrowded with female flowers or button nuts (up to 100 is satisfactory) : inflorescences in all stages should be visible on the palm carrying their full complements of developing nuts. Heavily loaded lower bunches may conceal deficiencies higher up. The best criteria are the number of nuts and the weight of the husked nut, which should be high. Palms growing in unusually favourable sites should not be selected. Yield records of the selected trees must be kept for at least 3 years. The weight of copra should be approximately equal to 32% of the weight of husked nuts. After 3 years all selections that have not produced 100 nuts and 175 lb. of husked nuts per annum should be discarded. In nut selection only fully ripe nuts should be used, preferably from the first bunch. II. Nuts should first be germinated in nurseries in raised beds of light, well-drained soil near to a water supply and if possible to the site of their future planting. It is advisable, though not always possible, to transplant before the roots have penetrated the husk and entered the soil, that is when the shoot is 4-6 inches long, in which case spacing in the nursery beds may be from 9-12 inches. Nuts should be planted flat on one side, this position reducing risks from drought and ensuring a more robust plant than upright planting. For selection at least 50% more

nuts than the required number of seedlings should be sown. Selection for transplantation should be for early germination, rapid growth and sturdiness. The two last are not apparent until the first two or three green leaves have developed. Mention is made of diseases and pests by which seedlings may be attacked and of possible control methods.

257. PIERIS, W. V. D., AND SALGADO, M. L. M. 634.61 : 581.084.2

Experimental error in field experiments with coconuts.

Trop. Agriculturist, 1938, **89** : 75-85, bibl. 3.

Individual yield records of a block of 300 coconut palms were statistically analysed by means of the analysis of variance. An 18-tree plot size is the optimum consistent with minimum standard error. The standard error of this size of plot is about 8-9% of the mean. [Authors' summary.]

258. ANON. 634.61-1.523

Coconut nurseries and selection of seedlings.

J. Mysore agric. exp. Un. (undated), **17** : 24-6, from *Madras agric. J.*, vol. **25**, No. 6.

Coconut seedlings should be raised in nurseries, a site consisting of a well-drained sandy soil close to a water supply being the most suitable. The best time for sowing in Madras is at the beginning of the south-west monsoon rains in May or June. The nut with the husk intact is set in the ground flush with the soil, or it may be buried in the ground to the depth of about 6 inches, the stalk end being upwards, this position having been proved to give the quickest germination. For transplanting at 9-12 months spacing should be 1-1½ feet. Germination will begin in the second and extend to the sixth month. Watering and shading are very necessary in dry weather. In the final selection for transplanting it should be noted that the following seedling characters have been found to be associated with early and high yield :—Early germination, large number of leaves, early separation of the leaflets in the seedling leaf spike, leafstalks short and strong and leaflets closely set, thick stem, many roots.

259. FOSTER, H. E. 634.61-1.8

Manurial experiments on coconuts.

Trop. Agriculturist, 1937, **89** : 63-7.

The results obtained in the fourth year of this manurial experiment, which is under the control of Imperial Chemical Industries (India) Ltd. in Ceylon, are reported. The age of the palms is 37 years. Nitrogen gave a highly significant increase in yield and a small profit which the addition of phosphate turned into a loss. Lack of response to phosphate was due to the detrimental effect it exerted in 1932 and 1933. In 1934 and 1935 it tended to be of benefit. Potash in the presence of nitrogen and phosphate was of significant benefit and the complete mixture gave a highly significant profit. The effect of seasons and the interaction of treatments with seasons were highly significant. The standard of accuracy in the experiment was high.

260. DWYER, R. E. P. 634.61-2.19 +2.4

The diseases of coconuts (*Cocos nucifera*) in New Guinea.

N. Guinea agric. Gaz., 1937, **3** : 28-93, bibl. 86.

An account is given of the diseases of coconuts due to fungi, physiological causes and soil deficiencies so far recorded in New Guinea. A comprehensive review is given of the literature of coconut diseases in other countries. In New Guinea the chlorotic deficiency diseases are important and are becoming more so as the plantations age. Tapering-stem and general collapse of the cabbage are associated with this. Root diseases are not frequent and can usually be attributed to unsuitable soil conditions. Infectious epidemic bud rot does not occur, such bud rot as there is being caused by lightning strike or fires (false bud rot) or following injuries of various kinds (sporadic bud rot) or due to soil exhaustion. Nut fall, which is not widely prevalent, can usually be associated with soil conditions sometimes combined with insect attack. Head droop is a suspected virus or physiological disease of which no description has hitherto

been published. Frond choke, a failure of the leaves to develop, is thought to be hereditary, though possibly it is environmental. Other diseases described, for which remedies are suggested where possible, are stem bleeding disease, thread blight, grey leaf blight, a bacterial leaf blight, leaf break, leaf drop, tipwither and ring disease.

261. BAIN, F. M. 634.61-2.19

Bronze leaf wilt disease of the coconut palm.

Publication Dep. Agric., Trinidad, 1937, pp. 48, bibl. 20.

The disease known as bronze leaf wilt of coconut, which has done much damage to palms in Trinidad, is studied and the conclusion reached that the disease arises from unsatisfactory conditions of water supply within the tissues of the palm, with occasionally unbalanced nutrition as a contributory factor. The latter condition can be overcome by the use of potash fertilizers. The types of soil on which the disease does and does not occur in Trinidad are listed. Some but not all of the former can be made fit for coconuts by applying certain principles of drainage which are described, trenching with organic matter, liming or potash manuring according to class of soil. Alternative crops such as sugar or tonca bean are suggested for permanently unsuitable areas.

262. ORGAS, A. M. 634.669

The lanzon (*Lansium domesticum* Jack.).

Philipp. J. Agric., 1937, 8: 77, bibl. 7.

The most suitable environment in the tropics for the lanzon is from sea level to 2,000 ft. in a situation free from strong winds, which damage fruit and flowers, and with a well-drained loamy soil. Propagation is by seed, grafting, budding or marcotting. Seeds are prepared by cleaning and air drying, otherwise the adhering flesh attracts ants. They are sown thickly under light shade and will germinate in 1 to 3 weeks. When they have made 2 pairs of leaves they are pricked out 40-50 cm. apart into nursery beds, where they remain for $1\frac{1}{2}$ - $2\frac{1}{2}$ years before the final planting out. Cleft grafting is usually adopted using a terminal, well-matured, non-petioled scion of the same age as the stock, 1 cm. in diameter and carrying 3 or 4 buds. It is usual to bury these scions for a month before use just under the surface of a sandy soil until the buds begin to start and the cut ends are on the point of callusing. Seedling stocks can be grafted at $2\frac{1}{2}$ - $3\frac{1}{2}$ years and will bear fruit 7 years after planting out. The directions for marcotting follow the usual lines. Sufficient rooting to admit of severance from the parent tree will take about 6 months. Cuttings made from half-ripened wood and set in beds of medium coarse sand under shade give about 50% strike. In the plantation lightly shaded trees give a higher yield than unshaded. Cultural care of young plantations consists of a twice yearly weeding to a distance of 1 metre from the trunk and a mulching given during the dry season. The fruit should be cut and not pulled off or the region from which springs the second set of fruit may be injured. There is in the Philippines a dangerous root disease of fungal origin which can only be dealt with by trenching round the tree, cutting off the affected roots and washing any others exposed in 4% formalin solution and finally adding unslaked lime to the trench to isolate the root system. The chemical constituents of the fruit and seeds are noted. A balance sheet showing the estimated expenses for the first 5 years after planting is given.

263. CHEESMAN, E. E., AND WARDLAW, C. W. 634.771-2.48

Specific and varietal susceptibility of bananas to *Cercospora* leaf spot.

Trop. Agriculture, Trin., 1937, 14: 335-6.

Of the 22 types and 2 sub-types in the collection of bananas at the Imperial College of Tropical Agriculture, Trinidad, 13 are definitely susceptible to *Cercospora* leaf spot, 8 are highly resistant or immune (as also to Panama disease) and 3 are mildly susceptible. Among the species collection there is a high degree of resistance. In the collection of Imperial College hybrids raised in the course of a breeding programme against Panama disease most of the plants are free from spotting. If spotting occurs in field plantations of any of these hybrids, e.g. I.C.2, it is invariably of the mild type.

264. SQUIRE, F. A., AND BRIANT, A. K. 634.771-2.73
Spotting of bananas caused by *Frankliniella insularis* (Franklin).
Trop. Agriculture, Trin., 1937, 14 : 351-2.
 Cases of spotting of bananas in St. Vincent leading to wholesale rejection of stems for export was traced to the thrips, *Frankliniella insularis*. It was controlled by the destruction of a host plant *Canavalia* sp. growing among the bananas.

265. THOMPSON, A. 634.774-2.3
Pineapple fruit rots in Malaya.
Malay. agric. J., 1937, 25 : 407-20, bibl. 14.
 A preliminary report is given of 3 pineapple fruit diseases which occur in Malaya on pineapples of the Singapore Canning variety. The diseases are known as fruitlet brown rot, broken core and fruit collapse. Brief descriptions of bacteria associated with these diseases are given. The adoption of a spraying programme is impracticable on the grounds of expense and the difficulties involved. Control of fruitlet brown rot will probably have to be obtained by breeding or selection of resistant strains and the adoption of a manurial system which would help to inhibit the development of rot in the tissues without affecting the quality of the fruit. The causes of broken core, which does not seem to have been reported from other countries, are still unknown. Fruit collapse may possibly be similar to the fruit fermentation of Sideris and Waldron* which they consider to be caused by yeasts which enter the fruit shortly before ripening.

266. CARTER, W. 634.774-2.752
The toxic dose of mealy-bug wilt of pineapple.
Phytopathology, 1937, 27 : 971-81, bibl. in text.
 The percentage of pineapple plants in Hawaii wilting as a result of infestation of mealy bug (*Pseudococcus brevipes* Ckll.) colonies of varying sizes increases with the number of mealy bugs. Usually there is a point on the dosage scale that brings a disproportionate rise in wilt percentage, increased dosages beyond this point resulting in only small increases in wilt percentage. Variability is high both in the toxicity of the mealy bug and in plant susceptibility. Certain of the experiments described indicate the possibility of a specific and perhaps transient state of the plant at the time of infestation. The influence of the soil complex on susceptibility must also be considered. In the conduct and analysis of these experiments due allowance has been made for these variables.

267. CLARA, F. M. 635.8
Culture of edible mushrooms in the Philippines.
Philipp. J. Agric., 1937, 8 : 225-9.
 The fungus used is the Philippine edible mushroom, *Volvaria esculenta*. Spawn is now prepared by the Philippine Bureau of Plant Industry. The beds consist of raised, flat-topped mounds of well packed and watered clay loam on which is placed a layer of manilla hemp refuse, banana leaf sheaths or old sacks. On these, after they have been well watered, the spawn is spread and covered with wet straw which is well pressed down to a depth of 15 cm. On this straw is placed more spawn followed by similar straw covering, and so on in successive layers of straw and spawn until the bed is about 1 m. high. The soil is kept moist by watering 3 times weekly in dry weather after the first week. The beds must be well drained as standing water affects growth. The first crop appears 17-20 days after spawning and should be harvested without damage while young. Pests and diseases are numerous, but their control has not yet been fully worked out for the Philippines.

* Sideris, C. P. and Waldron, G. C., *Pine. News*, 1930, Vol. 5, No. 4.

268. HOYER, F. 676.2
 Tropische Papierhölzer. (**Tropical paper plants.**)
Tropenpflanzer, 1937, **40** : 503-29, bibl. 75.
 A list is given of the principal plants offering possibilities of paper production. They are arranged geographically and notes are made of fibre measurements, specific gravity and botanical characters in each case. As a comparison fibre measurements are also given of plants commonly used for paper-making.

269. SCHÜSSLER, H. 677.42
 Wilde Seidenspinner. (**Wild silks.**)
Tropenpflanzer, 1937, **40** : 411-32, bibl. 13.
 Seventy-seven wild silk varieties are described here briefly.

STORAGE.*

270. KALTENBACH, D. 664.85
Different methods employed in the technique of fruit storage.
Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1937, **28** : 421T-33T, reproduced in *Hadar*, 1937, **10** : 249-51, bibl. 26.
 The technique is described of storage methods requiring the use of chemical agents acting either mechanically by checking respiration exchange or by destroying the pathogenic agents causing rots or by combining the two operations. The processes discussed are the use of borax, iodine wrappers, various gases, fatty or waxy substances for coating the fruit such as vaseline or Brogdex, ammonium bicarbonate, formalin, caustic soda, etc.

271. KALTENBACH, D. 664.84/5.035.1
Present knowledge regarding the storage of fruits and vegetables in carbon dioxide gas.
Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), 1937, **28** : 237T-49T, bibl. 28.
 A summary of the results obtained by the leading investigators on the gas storage of fruits and vegetables together with a description of the method and its working.

272. KESSLER, H. 664.85.035.1
 Das Problem der Aufbewahrung von Frischobst in kohlensäurericher und sauerstoffärmer Luft. (**Gas storage of fruit.**)
Landw. Jb. Schweiz, 1937, pp. 667-75, bibl. 15.
 The author gives a brief account of recent work on gas storage of fruit with particular reference to that on apples by Kidd and West in England. Among points noted are:—that considerable success attends the process, that mould formation is retarded and the danger of browning is eliminated, that different varieties require different concentrations, and that the apparatus needed is complicated and involves considerable expense.

273. KARMARKAR, D. V. 664.84.035.1 + 664.85.035.1
The refrigerated gas-storage of fruits and vegetables.
Agric. Live-Stk India, 1937, **7** : 735-44, bibl. 24.
 This paper consists of a review of the theory and practice of gas storage of fruits and vegetables and is concerned mainly with the work in England which has already been fully reported in previous numbers of Horticultural Abstracts.

274. KERDER, H. 664.85.13
 Weitere Ergebnisse des Kochbirnen-Lagerungsversuches. (**Further results of cooking pear storage trials.**)
Sonderabd. Schweiz. Zeitsch. Obst. u. Weinb., 1937, pp. 10.
 Trials show very great varietal difference in storage qualities. Storage at 0° C. or -1° C. is shown to be greatly superior to ordinary cellar storage, often prolonging storage life for 3 months.

* See also 45 and 188.

The pears successfully stored at 0° C. or -1° C. were the Kieffer, the Kamper Venus and the Holzerbirne. Baronsbirne kept in ordinary storage up to mid-February, while Arthurbirne showed itself entirely unsuitable for storage.

275. MEIER, K., AND GRAMPOLOFF, A. V. 535.21 : 664.85 + 664.84

L'action des rayons ultra-violets sur l'entreposage des denrées périssables.

(The effect of ultra-violet rays on the storage of fruit and vegetables.)

Reprinted from *Annu. agric. Suisse*, 1936, pp. 953-77, bibl. 18.

Exposure of tomatoes, peaches and strawberries stored at temperatures well over freezing point ca. 8°-12° C. to short daily irradiations (tomatoes approx. 3-7 minutes, strawberries 3-4 mins., peaches 5 min. 40 secs.) was very successful in prolonging the storage life of these fruits by checking the growth of different moulds. Total sterilization was not achieved owing probably to the lack of ray penetration to fungal spores or hyphae. An attempt to substitute soft X rays was unsuccessful, the fungi not being checked by these. The very considerable success achieved has led the authors to carry out further tests at higher temperatures, i.e. between 15° and 20° C., in the hope that it may be found possible in some cases to substitute for the great expense of cold storage the minor one of submission to ultra-violet rays.

276. RUEHLE, G. D. 664.85.11.037 : 632.4

Fungi which cause decay of apples in cold storage.

Res. Stud. St. Coll. Wash. 1937, 5 : 99-100.

This paper is an abstract of papers published some years ago in *Phytopathology* 1931, 21 : 1141-52 and *Bull. Wash. agric. Exp. Sta.* 253, 1931, pp. 48. They deal with fungi found to be causing decay of Washington apples in cold store. Blue mould caused by some 10 or more distinct strains of *Penicillium*—*P. expansum* being the most serious—caused 75 to 80% of the damage. The incidence of the particular rots varied according to the period of the storage season.

277. PLAGGE, H. H., AND MANEY, T. J. 664.85.11 : 632.19

Factors influencing the development of soggy break-down in apples.

J. agric. Res., 1937, 55 : 739-63, bibl. 21.

The apples used in the tests here described were Jonathan North-western Greening, Grimes Golden, Wealthy, Golden Delicious and Winter Banana. The maturity of fruit at picking affected its tendency to breakdown, but not always in the same direction for different varieties. Long delay before storing resulted in increased resistance to soggy breakdown. These facts suggest that susceptibility is associated with the stage of respiratory activity attained by the fruit when placed in storage. Only in one variety were large fruits found to be more susceptible to soggy breakdown than small fruits. Apple varieties from the same orchards in different years and from different orchards in the same year vary in susceptibility. Investigations over a number of years indicate that the best control of soggy breakdown is to store apples at 36° F. rather than at lower temperatures.

278. SMITANANDA, P. 664.85.41

A study of the storage temperature requirement of the fruit of atis, *Anona squamosa* Linn.

Phillip. Agric., 1937, 26 : 425-36, bibl. 31.

The average freezing point for ripe *Anona squamosa* fruit was -3.566° C. with an osmotic pressure of 42.26 atmospheres. Of the temperatures used in the experiment, 0°, 5°, 10°, 13°, 15°, 18° and 27.5° C., ripe fruit stored best at 5° C., but for a period of 5 days only. Though apparently still of full flavour at 7 days it had altered sufficiently in appearance to reduce its market value. Unripe fruit was best when held at 15° C., a temperature which retarded the ripening period to the 8th day. Similar fruit at room temperature, 27.5° C., ripened in 2 days. Unripe fruit stored at 13° C. never reached the edible stage, but if removed to room temperature about the 12th day, i.e. before it turned black, it ripened within 4 days with full aroma but lacking in sweetness. The respiration rate increases with maturity independently of the storage temperature used. The rate in the green stage is 137.34 mg. per kg. hour, in the ripe stage 283.55 mg.

279. NELSON, R. C. 664.85.11

The quantity of ethylene present in apples.

Plant Physiol., 1937, 12 : 1004-5.

A rapid chemical method for the determination of ethylene in plant material has been devised and is described. Using this procedure determinations of McIntosh apples (at Minnesota Experiment Station, U.S.A.) after 9 months of storage showed an ethylene content of 0.12 mg. per kg. of fresh tissue. Expressed on a volume basis this equals an ethylene content of 1 : 10,000 in the tissue, which is equal to the concentration calculated to be present in fruits ripened artificially in a chamber with the usual ethylene concentration of 1 : 1,000.

280. STAHL, A. L., AND CAMP, A. F. 664.85.3.037

Cold storage studies of Florida citrus fruits. I. Effect of temperature and maturity on the changes in composition and keeping quality of oranges and grapefruit in cold storage.

Bull. Fla agric. Exp. Sta. 303, 1936, pp. 67, bibl. 17.

The effects of various temperatures and stages of maturity on the changes taking place in the physical and chemical characteristics and the keeping quality of varieties of Florida oranges (Valencia and Pineapple) and grapefruit were studied. It was found that cold temperatures retarded the life processes, there being a direct relation between rate of change during storage and temperature. At any of the storage temperatures loss of weight during storage progressed with the degree of maturity at picking and storing. Storage pit, though negligible at all temperatures, was slightly more pronounced at the lower temperature levels. Decay, chiefly stem-end rot, increased with the higher temperatures and with length of storage period. The time fruit remained marketable after removal from cold storage to room temperature varied with the temperature and length of time at which the fruit had been held. Thus fruit held at 37.5° F. remained marketable longer than that at 32° F., and after 5 weeks at 37.5° F. was saleable after removal for 2 to 3 weeks, but if stored for 15 weeks it lasted under a week on removal. A temperature of 37.5° C. proved to be the optimum for storage of unwrapped, untreated oranges and temperatures under this were better than temperatures over. In grapefruit, (Silver Cluster and Marsh Seedless), severe pitting occurred after several weeks of storage at 32° and 37.5° F. but not at 54° and 58° for the same period. Decay was negligible at the 2 colder temperatures and very severe at the 2 warmer. On removal from storage to room temperature fruit from 37.5° and 42° F. remained longest in saleable condition, and the former temperature is considered to be the most suitable.

281. STAHL, A. L., AND FIFIELD, W. M. 664.85.3.037

Cold storage studies of Florida citrus fruits. II. Effect of various wrappers and temperatures on the preservation of citrus fruits in storage.

Bull. Fla agric. Exp. Sta. 304, 1936, pp. 78, bibl. 17.

The effects on the fruit which were considered in this study of 22 kinds of wrapper and 6 storage temperatures were general appearance, taste, loss of weight, limits of storage period and of holding period after storage, and occurrence of pitting and of decay. Various storage temperatures between 32° and 58° F. were used and room temperatures of 70°-80° F. Moisture-proof wrappers were superior in preserving weight and general appearance to semi-moisture proof, and all wrappers were better in controlling pitting than none at all. At temperatures below 42° F. decay in all wraps was negligible, above it varied directly with temperature, length of storage period and moisture retentiveness of the wrappers. Pitting was controlled by increase of temperature and not by type of wrapper. Eighty-seven per cent. of the Valencia oranges after 5 months' storage at 37.5° F. were purchased in preference to unstored Californian fruit at the same price. Decay was higher in the bulge than in the straight pack. Grapefruit at the optimum storage temperature of 37.5° F. kept for 3-4 months in moisture-proof wrappers, from 2 to 3 months in semi-moisture-proof wrappers and for 6 weeks in plain tissue. The combination of tissue wrap and moisture-proof box lining was the most satisfactory.

282. STAHL, A. L., AND CAIN, J. C. 664.85.3.037
Cold storage studies of Florida citrus fruits. III. Relation of storage atmosphere to the keeping quality of citrus fruit in cold storage.
Bull. Fla agric. Exp. Sta. **316**, 1937, pp. 43, bibl. 41.

A high humidity in cold storage was desirable to conserve firmness and weight and to restrict pitting. O_2 and CO_2 were harmful to taste and texture of grapefruit and O_2 increased pitting. Sogginess was definitely produced by CO_2 and a musty taste by N_2 . Forced air circulation in storage adversely affected texture, length of storage life and weight. Fruit stored in a still air low in CO_2 and O_2 (6% and 12% respectively) and high relative humidity at 37° F. will keep in good physical condition for 4 months.

PACKING, PROCESSING, PLANT PRODUCTS.

283. BURTON, C. 634.11-1.564
Starting a central apple packing station.
J. Min. Agric. Lond., 1938, **44** : 1073-80.

An account of the formation, working and accounting of a privately owned (syndicate) central apple packing station in Essex for the collection, packing and marketing of the fruit of shareholders.

284. FRUIT PROCESSING CTTEE. 664.85.22.047
Processing of prunes.
J. Dep. Agric. S. Aust., 1937, **41** : 19-22.

Lists are given of prunes suitable and unsuitable for drying. Cultural operations, though not directly connected with drying, play an important part in the production of high grade prunes. The first-fallen prunes are usually deficient in sugar and should not be allowed to mix with the mature fruit that falls later. The highest quality prune is produced by fruit which ripens, wilts on the tree, and then drops, full ripe unwilted and unripe fruit are of lower quality and the latter class, especially if allowed in the pack in any but a very small proportion, will materially reduce the general quality. Dipping prior to drying is not standardized. The best French prunes are not dipped at all and for the others a weak dip of 1 lb. caustic soda, provided it is kept boiling, is as satisfactory as any of the stronger dips in more common use. Drying (various methods are briefly mentioned) should be brought to the stage when the prune is sufficiently dry to store in bulk, and to allow of the addition of further moisture during processing. Figures as to optimum moisture content at this stage are not available. The fruit is now stored in bulk for five or six weeks to allow of slight fermentation and the assumption of a uniform moisture content. Occasional turning during this period is necessary. A short account is given of factory processing and of a more specialized treatment for dessert prunes.

285. JEWELL, W. R. 664.85.21.047
Moist-pack processing of dried apricots.
J. Dep. Agric. S. Aust., 1937, **41** : 23-5.

A moist pack of dried apricots being now regarded as more or less essential on the market, attention is drawn in this paper to certain points which should be observed to obtain the best results. Grading for colour and size and the picking out of faulty pieces by hand is necessary for the overseas market. Moistening is accomplished by immersion in water at 180° C. or by steaming followed by partial drying. The limit to which moisture should be raised for fruit for export is 20%. At the moment there is no rapid method for the determination of moisture content. Moist packed apricots lose sulphur dioxide and therefore their bright colour rather quickly, therefore it is essential that immediately after processing they should contain 14 grains sulphur dioxide per lb., the limit allowable. This can only be achieved by re-sulphuring after processing and reference is made to a rapid workshop method, for which technical training is not needed, of determining the sulphur content (*Australian Dried Fruit News*, 26/12/36, p. 3).

Moist packed apricots deteriorate quickly and it is preferable to moist pack progressively as the demand requires, preferably immediately before sale. Badly darkened fruit can be restored to brightness by immersion for 10 minutes in warm water followed immediately by re-sulphuring. In sulphuring the apricots should be graded and the grades treated separately.

286. FELLERS, C. R. 577.16 : 634/5-1.56

The effect of processing on vitamins in fruits and vegetables.

Bull. Mass. agric. Exp. Sta. 338, 1936, pp. 23, bibl. 235.

The author collects and briefly summarizes the findings of recent investigators. The large bibliography would be even more useful to the student, were the titles of the papers given and not merely the names of authors and journals. The following notes are taken from the author's summary :—Generally speaking, ordinary storage and to a lesser extent cold storage in air have no serious effects on vitamins D, E and G, have a slight to moderate destructive action on vitamins A and B, and cause serious loss of vitamin C, particularly when storage is long continued. Losses are reduced when storage is near the freezing point. Shipped-in vegetables may lose substantial quantities of vitamin C during shipment and incidental marketing operations. This is not true in the case of most fruits and such acid vegetables as tomatoes and rhubarb. Properly packaged frozen fruits and vegetables show practically no losses in any of the vitamins even after long storage at 0° F. or below. Destruction of vitamin C is very rapid when frozen fruits and vegetables are defrosted in air. Little loss in vitamin C occurs if solidly frozen vegetables are cooked in boiling water without previous defrosting. Sun-drying is more destructive to vitamins A and C than artificial dehydration. Fermentation of fruits and vegetables is injurious to vitamin C. In general, heat treatments such as cooking and canning are not injurious to any of the vitamins, but the accompanying oxidations and other destructive reactions, unless carefully controlled, are decidedly injurious to vitamins B and C. Fruits or vegetables containing added acid may be heated with less destruction to vitamins B, C and G than non-acid foods. Thus, canned fruits retain vitamin C very well, while canned vegetables lose much of their original C. Modern methods of vacuumization and air removal and sealed packaging now used in the food preservation industries are practical aids in preventing vitamin losses through oxidation. It is not believed that cooking and canning are harmful to the vitamins A, G, D and E of fruits, vegetables and cereals. Heat in the presence of alkalies is very destructive to all the vitamins. Rapid cooking, with minimum exposure to air, serves to minimize losses of vitamins C, A and B. Food manufacturing operations such as blanching, open-kettle cooking, pulping, and filling containers are ordinarily destructive to vitamin C and probably to a lesser degree to B and A as well. There is no satisfactory evidence that foods once canned lose appreciable quantities of any vitamins on storage. Losses of vitamins C and A in reheating canned foods for table use are small. Large quantities of the water-soluble vitamins B, C and G are dissolved in the cooking water of fruits and vegetables and are lost unless this cooking water is utilized.

287. SUGA, Y.

Canning the mandarin orange in Japan.

Canning Ind. Packing Gaz., 1937, 7 : 4-5.

The type of mandarin orange most favoured by canners has the thinnest possible skin ensuring a larger fruit content, and when peeled 9 large segments of deep bright colour. The oranges are stored before sending to the cannery. This has the advantage of making the flesh of the segments firmer and eliminating chances of deformation in the tin which destroys the clarity of the syrup. The processes include grading, peeling, and segmenting before chemical treatment. The chemical treatment is necessary to remove the skin from the segments and consists in immersion for 20-40 seconds in $\frac{1}{3}\%$ solution of caustic soda heated nearly to boiling point, followed by washing to remove any alkaline residue. Segments are then graded into 3 sizes, quality depending on uniformity and colour which should be bright golden. The cans are filled with water before packing which flows out as the segments are filled in, superfluous water being drained out before syruping. Sterilization takes 12 minutes in a number 5 can. It is

stated that the canning of mandarin oranges in Japan was stagnant until the introduction from California in 1926 of the chemical method of skinning which replaced the laborious and unsatisfactory hand method.

288. CHARLEY, V. L. S.

663.813

Fruit juices and syrups.

Chem. Ind., 1937, 56 : 608-15, bibl. 7.

Citrus. Citrus juices are preserved, after expression, by the inclusion of 600 parts per million of SO₂ and are imported into the U.K. in 60-gallon casks. Syrups are prepared by the incorporation of sugar syrup with a filtered juice until the sugar content is 35%-50%. They are preserved by the use of SO₂ at the rate of 200-300 parts per million by weight in the form of potassium metabisulphite or calcium bisulphite or liquid SO₂. *Apple and grape.* The Seitz-Bochi process for concentrating apple juice is described. The filtered product is impregnated with CO₂ and is stored in large steel cylinders, specially lined with a sevenfold enamel or with so-called "Ebon" lining. It will then remain without fermentation for an indefinite period. Bottling is done after removal of CO₂, clarifying, sterilizing and sometimes re-aeration with CO₂ at 20 lb. per square inch pressure. Other methods of stabilizing the juice here described are the Matzka, Katadyn and Schoop processes and flash pasteurization. The first attempts at apple juice manufacture in England were made in 1936 and work on the subject is in progress at Long Ashton. As regards grape juice, the processing of this is more complex owing to the necessity for heat treatment to remove colour. In grape juice as opposed to apple juice separation occurs of excess acid potassium tartrate. Its deposition is hastened by low temperature storage. *English soft fruit juices.* A start was made in 1936 of the commercial production of pure fruit syrups at Bristol, some 55,000 gallons of syrup being made. The fruits concerned were strawberry, raspberry, loganberry, black currant and blackberry. The following operations of processing are described:—milling, pectin removal, pressing, juice clarification, syruping process, stabilization of syrup and filtration. The flavours of the syrups produced were good and definitely of the fresh fruit type, except in the case of black currants in which a cooked flavour was noticeable. As regards fruit concentrates the freezing process, when it can be economically used, i.e. in the absence of excessive sugar concentrations, will produce concentrates possessing full flavour. A scheme has been worked out between the Ministry of Agriculture and the National Association of Mineral Water Manufacturers whereby the National Mark syrups will form the basis for a series of aerated English fruit juices of guaranteed and standard composition. *Miscellaneous juices.* The production of passion fruit juice offers certain difficulties which are under investigation. Other juices produced elsewhere, but so far in small quantities, include pineapple, pomegranate, peach, pear and cherry. The figures of analyses made at Long Ashton in recent years of some sixteen different fruits and presented here give details of specific gravity, acidity expressed as citric acid, tannin, ash and ascorbic acid content.

289. MORRIS, T. N.

663.813

The concentration of fruit juices by freezing.

Chem. Ind., 1937, 56 : 615-8.

After a brief discussion of the methods adopted for concentrating fruit juices by Gore in the U.S.A., Eudo Monti in Italy and by workers in Holland the author describes his own experiments which were based on Gore's freezing and centrifuging methods. Recently a Dr. Krause has invented and patented a type of freezing vessel the essential feature of which is that it moulds the ice to fit the separating device exactly, the latter being a centrifugal machine. The operations involved are described and certain apparent disadvantages are noted. The changes occurring on storage in concentrated fruit juice—with special reference to orange—are considered. They include solidification to a jelly, darkening and loss of flavour. It is suggested that for really successful storage of orange juice for long periods without added preservatives a temperature of about -20° C. is needed. There is likely to be considerable difference in optimum temperatures for different fruits, but in general it may be said that the lower the temperature the more likely is concentrated fruit juice to keep unaltered.

290. REAVELL, J. A. 663.813 + 664.85.047

Recent work on the concentration of fruit juices and fruit drying.*Chem. Ind.*, 1937, 56 : 618-21.

The author describes with diagrams recent improvements in the Kestner evaporator used for concentrating fresh fruit juice. Juices can now as a result be taken to high concentrations, e.g. 85% evaporation, without losing the fresh fruit value in the process and can be kept for long periods without the addition of sugar or any other preservative. The choice of stainless steel for the apparatus needs considerable care. Some useful results have been got by using a non-metallic substance called "Keebush" for those parts which do not have to transmit heat, and investigations on its possibilities are still in progress. In addition an efficient process for producing soluble powders from fruit juice is described in detail. Only a few notes are given on drying fruits.

291. DANIEL, E. P., AND RUTHERFORD, M. B. 577.16 : 634.3

Ascorbic acid content of a number of citrus fruits.*J. agric. Res.*, 1937, 54 : 689-93, bibl. 4.

Ascorbic acid measurements were made by the titration method described by Bessey and King (*J. biol. Chem.*, 1933, 103 : 687-98) on a number of samples each of several varieties of citrus fruits. The ascorbic acid values of the juices of the 8 varieties of orange varied within the limits of 0.32 and 0.62 mg. per c.c. of juice. All the grapefruit except Tresca, which showed 0.64 mg., showed values in the region of the lower values found for the oranges. The average of 6 samples of Umatilla "tangor", a tangerine-orange hybrid, was 0.40 mg. Values shown by the few samples of tangerines, limes, limequats and orangequats tested were about half those found in most of the orange varieties. Values for 8 varieties of tangeloes, a grapefruit tangerine hybrid, ranged from 0.64 mg. to 0.18 mg. Lemon lime hybrids, "the Perrine lemon", showed 0.40 mg. for fresh fruit and 0.24 and 0.26 mg. for fruit picked in the ripe yellow and light green stages respectively and kept for 2 months in cold store.

292. SAPOZHNIKOVA, E. V. 634.67 : 581.192 : 547.477.1

Fruits and berries as source of organic acids. [Russian, English summary $\frac{1}{2}$ p.]
Bull. appl. Bot., Leningrad, 1934, Ser. III, No. 5, pp. 349-60.

The studies were conducted by the Institute of Plant Industry. Most of the material used in the experiment was received from the Krasnyi Pakhar collective fruit farm. The author reached the following conclusions :—1. The tests of changes in acidity, taking place as berries ripen, showed that both the total amount and the qualitative composition of acids were not constant, but were characteristic of different forms. 2. Great interspecific and intraspecific variations of the qualitative composition of acids in ripe berries were found. 3. Cultivated pomegranates contained exclusively citric acid. In fully ripe fruit the amount of acid was considerably lower. 4. The juice of wild pomegranates also contained exclusively citric acid, the amount being greater. The author suggests that wild pomegranates should be utilized as a source of citric acid. 5. He suggests that the crystallization method adopted by the Azerbaijan Station of the Institute of Plant Industry should be used for the purpose. [No details are given.—ED.] 6. The black mulberry in unripe condition was found to have a citric acid content of 15% of dry weight. 7. It is further suggested that not only should organic acids be obtained from fruits and berries, but also that the intraspecific variation in acid contents of berries should be used as a means for establishing the relationship of varieties and species.

293. LIOSIN, M. 634.38 : 581.192 : 547.47

The content of organic acids in the leaves of *Morus alba*. [Russian.]
Sovetsk. Bot., 1937, No. 1, pp. 121-8, bibl. 13.

A description of analyses made of *Morus alba* (mulberry) leaves, collected in Tbilisi in August 1933. The age of the trees is not stated. The author summarizes his results as follows :—1. We tested the leaves of *Morus alba* taken from the top, the middle and the bottom branches

of the tree for their content in oxalic, tartaric and malic acids by the method of splitting up the lead salts. 2. In water extractions of similar leaves citric acid was separately determined in its pentabromacetone compound. 3. The results, which are tabulated, show that the total amount of the four above mentioned acids varies from 4 to 5 g. per 100 g. dry weight. The amount of oxalic acid in leaves decreases from the top branches downwards, while the amount of citric and malic acids increases.

294. REIFENBERG, A., AND BRISK, L. 634.31 : 582.822.3

The use of orange peel for the manufacture of yeast.

Hadar, 1937, 10 : 197.

The production of yeast from the discarded orange peel of Palestine juice factories is discussed. Two tons of dried or 10 tons of fresh peel would be required daily to cover the daily consumption (800 kg.) of baker's yeast in Palestine.

295. CHILD, R. 634.61 : 665.3

Edible coconut oil.

Trop. Agriculturist, 1937, 89 : 270-80, bibl. 13.

The processes used commercially in the preparation of coconut oil of edible grade and the modified forms under which the oil is marketed are discussed and the possibility of the application of any of them to export or local marketing in Ceylon is considered. Analytical reports of various local samples are tabulated and compared with figures from literature.

296. GEORGI, C. D. V. 665.353.4

Sampling of palm oil.

Malay. agric. J., 1937, 25 : 457-68.

Methods are suggested for sampling palm oil on estates, which it is hoped will lead to an increased accuracy, a matter of considerable importance in marketing the oil. It has been found that the apparent increase of acidity of the oil between the time of leaving the estate and the time of its receipt in Singapore is occasionally so abnormal that it can only be accounted for by faulty methods of sampling, which occur, presumably, in view of certain difficulties of estate sampling, more frequently at the estate end.

297. GEORGI, C. D. V. 665.353.4

An improved method of drying palm kernels.

Malay. agric. J., 1937, 25 : 454-6.

A machine constructed locally in F.M.S. is described which affects the necessary moisture reduction in palm oil kernels in $1\frac{1}{2}$ hours without affecting the quality. The underlying principle is the continuous movement of the kernels while they are being heated to a definite temperature of 55° - 60° C. An advantage of this form of drier is that kernel manufacture becomes a continuous process, the stored nuts being cracked and the kernels bagged on the same day. The capacity of the machine is 10 cwt. of kernels for an 8 hour day.

298. KRAAY, G. M. 633.912 : 678.11

Waarnemingen over het oproomen van latex met eenige plantenslijmen.

(**Observations on the creaming of latex with some vegetable mucilages.**)

Arch. Rubbercult. Ned. Ind., 1937, 21 : 16-22.

The following vegetable mucilages have been found to have the property of creaming latex:—a Chinese powder known as sioeng-voengka, an extract of the leaves of *Hibiscus rosa-sinensis*, an extract of unripe cacao pods, an extract of mango fruit, and the mucilage contained in the leaves of a species of *Aloe* known locally as lidah boeja. The mucilage from the leaves of *Hibiscus* seems the most promising.

299. VYSHINSKY, V. A. 547.566.1 : 633.85

Anethole. [Russian.]

Bull. appl. Bot., Leningr., 1935, Ser. A, No. 14, pp. 173-6.

During the expeditions conducted by the author in 1932 and 1934 for the U.S.S.R. Institute of Plant Industry, *Heracleum Lehmannicum* Bge. (*Umbelliferae*) was found growing in many parts of Tadzhikistan. Biochemically analysed this essential oil plant was found to contain 80% anethole, for which there is a great demand particularly in the colour film industry. The discovery is said to be of great importance, attempts to produce $C_{10}H_{12}O$ synthetically having failed so far. At present most of the anethole on the world market comes from U.S.S.R., where it is manufactured from the seed of *Pimpinella Anisum* L. and *Foeniculum vulgare* G. Boissier's description of the plant is given here (Fl. or. ii-1045) and a table shows the content of essential oil and $C_{10}H_{12}O$ in *Heracleum* leaves as compared with that found in the seed of the other two *Umbelliferae*. Further studies are being carried on by the Institute of Plant Industry with this plant for the purpose of using it as raw material in the manufacture of essential oils and anethole.

300. IMPERIAL ECONOMIC CTTEE., LOND. 633.72 + 633.73 + 633.74 + 633.61/3 + 633.83 + 633.71 + 633.912

Plantation crops.

H.M. Stationery Office, Kingsway, London, W.C.2, 1937, pp. 104, 2s. 6d., 2s. 9d. post free.

In 1931 and 1932 the Imperial Economic Committee issued reports (Nos. 18, 19 and 22) on the production and international trade, with special reference to the part played therein by the countries of the British Commonwealth of Nations, of tea, coffee and cocoa. In the present report the figures there given are brought up to date and similar data are presented on sugar, spices, tobacco and rubber.

301. IMPERIAL ECONOMIC CTTEE., LOND. 633.5

Industrial fibres.

H.M. Stationery Office, Kingsway, London, W.C.2, 1937, pp. 128, 2s. 6d., 2s. 9d. post free.

Figures of production, trade and consumption relating to cotton, wool, silk, flax, jute, hemp and rayon, from 1929 to 1936—with special reference to the countries of the British Commonwealth of Nations—are summarized and discussed.

NOTES ON BOOKS AND REPORTS.

302. ECKSTEIN, O., BRUNO, A., AND TURRENTINE, J. W. 631.83 : 632.19

Potash deficiency symptoms. [German, French and English.]

Verlagsgesellschaft für Ackerbau m.b.H., Berlin S.W.1, 2nd edit., 1937, pp. 234, 54 coloured plates, bibl. 209.

This work covers a wide range of crops and an immense task has been accomplished with considerable success. It should, however, be regarded rather as a staccato summary of research than as a complete work in itself and reference should be made to the authorities indicated in connexion with any particular aspect. The first section deals with the effects of potash deficiency on the various parts of the plant and on resistance to diseases, pests and adverse climatic factors. The second deals specifically with some cultivated crops, including fruit trees. In this there is an unfortunate transposition of Wallace and Hoblyn in the references. Many half-tone and coloured illustrations are given as a guide in the recognition of potash deficiency symptoms. The authors are, however, careful to point out that such symptoms indicate an advanced stage in the deficiency. Unfortunately the illustrations are not all of a high standard. W.A.B.

303. ZHUCHKOW, N. G. 634.1/2-1.541.11
The production of dwarf fruit trees on new lines. [Russian.]
 Selkhozgiz, Moscow, 1936, pp. 208, bibl. 58, roubles 2.50.
 This is a Russian manual describing the cultivation of dwarf trees. Considerable attention is paid to special training methods, espaliers, etc. Modern work on standardization of fruit trees by use of clonal stocks is discussed. It would not appear to contain anything fresh to those acquainted with recent European and American investigations.

304. AMANI. 632/3
Ninth Annual Report East African Agricultural Research Station, Amani, for 1936-7, 1937, pp. 47, H.M. Stationery Office, London, 1s.
 The establishment and large-scale propagation of a high yielding clone of *Derris elliptica* is noted. The plants raised from this clone are now being distributed and importation of *Derris* plants into East Africa has been prohibited to prevent eventual adulteration of the East Africa strain which, it is hoped, will acquire a high reputation on the market. Other strains are under trial but will not be released unless of undoubted superiority. The work in progress on virus diseases of cassava is briefly discussed, as is the work on the stomatal behaviour in coffee (*C. arabica*) leaves in the field. Reports of the geneticist, soil chemist and entomologist are included.

305. CANADA, NATIONAL RESEARCH COUNCIL. 634.11 : 581.46/7 + 632.111
Nineteenth Annual Report, 1935-6, Ottawa, pp. 166.
 A study of the development of the apple from bud to full fruit is one of the Assisted Researches and is being carried out at Kentville Experiment Station, Nova Scotia (pp. 124-5). The problem is divided into 4 parts:—(1) Life history with special attention to time of fruit bud differentiation. This has been found to occur (McIntosh Red) nearly a month earlier than in England and U.S.A. (2) Development of the protective layers of the apple. (3) The nature of russetting. (4) Technique of sectioning winter buds of the apple. A special technique is required owing to the large quantity of hairs surrounding the flowers. Frost resistance in plants, under the direction of Dr. G. W. Scarth (p. 125), is another Assisted Research. Two important changes in the process of hardening taking place in the living protoplasm have been discovered and the probable rôle of these factors in frost resistance has been considered. It has also been ascertained that in very hardy plants a great increase of hydrophilic colloid takes place in the vacuole, which has been shown to be of great importance. The whole study is being made the basis of a theory of frost resistance. Several papers are in preparation on each of these researches.

306. CANADA. 63
Report of the Minister of Agriculture for the Dominion of Canada for year ended March 31, 1937, Ottawa, 1937, pp. 111, 25 cents.
 The report contains brief notices of the research work in progress at the many experiment stations of the Dominion. Full details are obtainable from the station reports which are published separately.

307. DOMINICA, B.W.I. 634.337-1.541.11
Report of the Agricultural Department for 1936. Issued by I.C.T.A., Trinidad, 1937, pp. 32, 6d.
 The progress of trials with limes at the Experiment Station, Dominica, is reported. *Rootstocks.* The young limes on rootstocks of grapefruit, rough lemon and sour orange have yielded in this descending order yearly for a period of five years. The differences are not yet analysed but do not appear to be great. *Budded versus grafted limes.* Yields in 1936 from grafted trees planted in 1929 were at the rate of 132 barrels per acre and from budded trees of similar age 69 barrels per acre. *Shade.* A trial of limes under shade trees and without shade is in progress but not yet recorded. *Topworking grapefruit with limes.* This trial has been started in view of the indications that limes on grapefruit stock give a heavier yield with the added advantage of producing a tree of dwarfer growth and more spreading habit. Grapefruit stocks, however,

are susceptible to gummosis and are easily uprooted in high winds. The grapefruit now top-worked to lime are on sour orange roots and it is hoped that a combination of the desirable characteristics of stock and intermediate may be obtained. Conversely, limes on rough lemon and grapefruit stocks have been topworked with grapefruit. An appendix contains the report of Dr. C. W. Wardlaw on the banana-producing areas of the island. This report is of interest in that it details the precautions to be taken in combating and isolating local outbreaks of Panama disease in districts where the peasant proprietors are not well informed.

308. HATTON, R. G. 634.1/8
Survey of deciduous fruit growing in the principal areas of the Union of South Africa. Government Printer, Pretoria, 1936, pp. 45, bibl. 23.

The author here gives the impressions gathered during a rapid 7 weeks tour of 7,000 miles through a large part of the Union orchards, deciduous and citrus, made at the invitation of the Union Government. For a history of the development of South African fruit growing the reader is referred to Reinecke's Survey of the fruit orchards of the Western Cape Province, *Sci. Bull.* 77, 1929, and to van Wyck's Export of South African Deciduous Fruit 1880-1930, *Sci. Bull.* 135, 1935. In a readable but concise form Dr. Hatton picks out the various points and problems noted and briefly discusses their causes and possible remedies. The following notes give some of the main points made in his very full summary. Varieties and species grown are not always suitable for the environmental conditions and specialization is taking place largely through the gradual elimination of the unfit. Climatic conditions—great variations in temperature and rainfall—are probably profoundly affecting the whole industry and this does not appear always to be appreciated. Thus adverse conditions have been exaggerated by a cycle of low winter rainfall coupled with high winter temperatures. There is a tendency to sell at varying stages of maturity in order to catch the early market and a more closely co-ordinated plan between the different districts seems called for. Irregular blossoming and foliation due to climatic conditions are of vital importance and the problem should ultimately be solved by selection of adaptable varieties, meantime the remedial oil sprayings recommended for inducing more uniform blossoming are worthy of serious attention. The incidence of physiological disorders such as little leaf, chlorosis, die back, etc. has been correlated with soil differences in various districts and a wider appreciation of Malherbe and du Toit's findings is necessary. Some cases are capable of amelioration by cultural methods, e.g. application of zinc sulphate, but in others the abandonment of fruit growing in the particular area may be essential. Although there is no evidence that the major troubles are due to rootstock problems, there would appear to be plenty of scope for the establishment of clonal stocks both for experimental purposes and for general use. A large part of the report deals with the author's suggestion for the co-ordination of effort towards the establishment of a prosperous fruit growing industry in the Union. In this, growers, research workers and the Department of Agriculture will have to co-operate. He further stresses the necessity for close co-ordination of effort between research on production and on storage.

309. HORTICULTURAL EDUCATION ASSOCIATION. 634/5 + 635.9
Scientific Horticulture, 1938, Vol. 6, pp. 260, Editor, S.E. Agric. Coll., Wye, Kent, 4s. plus postage 6d.

The papers presented at the 1937 Revision Course in Horticulture on Flower growing and the flower industry in Great Britain are given in full and are followed by articles summarizing our present knowledge on the following points:—the temperature requirements of tulips and daffodils, growth promoting substances, boron deficiencies in horticultural crops, the importance of chromosomes in horticultural work, potato virus. The practical aspects of the recent John Innes work on incompatibility in sweet cherries described in *J. Pomol.*, 1937, 15 : 86-116, *H.A.*, 1937, 7 : 564 are discussed. Swarbrick deals with modified leader pruning. Finally reviews are given of 18 recent books and reports. Abstracts of the more important papers will appear in *H.A.*, 8 : 2.

310. INDIAN TEA ASSOCIATION. 633.72
Annual Report Tocklai Experimental Station for 1936,
 1937, Mycological, Botanical and Bacteriological Branches, pp. 16;
 Chemical Branch, pp. 11; Agricultural Branch, pp. 73.
Mycological, Botanical and Bacteriological Branches. In the control of black rot the year's experiments indicated that spraying with 1% burgundy mixture during the plucking season on infected bushes only was effective, that lime-sulphur reduced the infection but was inferior to burgundy mixture, that spraying with either during the cold weather had little effect on the incidence of black rot during the following season, and that the effect of the removal of prunings was negligible. *Chemical Branch.* Potash manures were found by the Chemical Branch to result in a slight but significant depreciation in the value of tea in Calcutta and London. Phosphates increased the value in Calcutta but not in London. In both places pruned was valued significantly higher than unpruned tea. The influence of certain factors on the moisture in plucked leaf was seen in small but significant increases of moisture in leaf from bushes plucked to 8 inches compared with those plucked to 4 inches above the pruning line and in coarser plucking with increased quantities of complete inorganic fertilizer. *Agricultural Branch.* As a result of a hail storm which removed practically all the leaves of a recent flush and followed a drought the number of deaths, which was considerable, was influenced by jat of bush and manuring, thus light leaf jat proved more delicate than dark leaf, and a higher mortality obtained among plants receiving 300 lb. sulphate of ammonia per acre than among those receiving 100 lb., the manures being applied just before the hail. No significant effect in the number of deaths was obtained on the superphosphate or sulphate of potash plots. Pruned tea yielded more highly than unpruned tea at Tocklai, but at Tulispara the reverse was the case. The great benefit to the building up of a young bush of allowing an unpruned year is shown. Pruning and manuring experiments are discussed at considerable length.

311. MYSORE. 63
Report Mysore Agricultural Department for year ending June, 1936, pp. 179 (received Jan. 1938).
 The report deals mainly with administrative work and experimental work on sugar cane, rice, and cotton. Of work in other directions the following notes are of interest. Investigations on various plant products for their insecticidal value have obtained promising results from 33 species, and 2 of these, *Tephrosia candida* and *Mundulea suberosa*, have been selected for detailed chemical investigation. Large quantities of highly active concentrates have been obtained from both substances. With coffee an adequate amount of potash combined with a moderate shower of rain has been shown to be necessary for successful fruit set. In trials of grafted coffee *arabica* strains on *robusta* do well in the nursery but not in the field. Pure *arabica* strains on *arabica* hybrids are more successful. In root studies the root development and penetration of *arabica* hybrids was found to be greatly superior to that of pure *arabica*.

312. SMITH, A. J. M. 664.85.037
The pre-cooling of fruits in South Africa. Government Printer, Pretoria, 1937, pp. 84, bibl. 292, 6d.
 This careful and detailed report is not provided with index or even list of contents. It is actually in 6 divisions:—I. *The South African fruit export industry.* A brief history of fruit exports from S. Africa is followed by notes on present facilities for pre-cooling at Capetown, Durban, Port Elizabeth and East London. The districts supplying these ports, the chief fruits supplied in each case, and the difficulties arising from transport over long distances are discussed. A note is given of the facilities afforded by the government-controlled railway system between packing house and port. II. *Pre-cooling technique in other countries.* This section deals mainly with technique in U.S.A., especially California and Florida, brief references being made to pre-cooling of fruit from Australia and New Zealand. III. *Some physical aspects of pre-cooling.* Here the author sets out to show how far theoretical treatment can be pushed, what conclusions emerge from it and what problems are suggested for study by empirical experiment. In this

section all such factors as wraps, linings, size of package, etc., and the latest methods of pre-cooling by portable fans receive attention and a note is given on results achieved in the experimental hold at the Ditton Laboratory, Kent, England. The different methods of packing different fruits adopted in S. Africa are described and found to be extremely varied. The possibility of accelerating cooling by the use of greater air speed or lower temperature is discussed.

IV. Biological aspects of pre-cooling. The effect of different degrees of temperature on different fruits at different stages of maturity is noted. Notes are given here not only on fruits exported from South Africa but also on such fruits as bananas, tomatoes, avocados and mangoes. The results of gradual as opposed to sudden exposure to low temperature still need investigation. Evidently they differ with different fruits and with different stages of maturity in those fruits.

Although the cooling of fruits immediately after picking has generally been found beneficial, it cannot be followed as an unalterable principle without regard to the maturity of the fruit.

V. The new pre-cooling stores in South Africa. A brief technical description is given of the new stores recently built at the ports. **VI. General comments and summary.** Some of the particular features of the new stores are briefly discussed and some general comments are offered on the pre-cooling of export fruit and the latest methods for obtaining efficiency. Attention is drawn to the comprehensive bibliography.

313. SOUTH AFRICA, UNION OF.

634

Annual Report of the Department of Agriculture for year ended 31 Aug., 1937.

Fmg S. Afr., 1937, 12 : 469-596.

This number contains the full text of the annual report. The section dealing with fruit (pp. 504-6) is concerned chiefly with problems arising from export. The success of the new national mark scheme (p. 491) after only a year's working is mentioned. It has been greatly helped by special sections in the Johannesburg market having been allotted to national mark produce, which is auctioned at specific times. In the report of the Stellenbosch-Elsenburg College of Agriculture, which is included, certain research work in progress is mentioned (pp. 588-9). This includes rootstock selection and propagation of deciduous tree fruits, a comparative trial of budding and grafting methods, the recording of data in connexion with the problem of delayed foliation both as regards immune varieties and the action of various oil emulsions in assisting normal functioning, and the influence of delayed foliation on woolliness of the peach. The department of viticulture continued investigational work on soil cultivation and on pruning, topping and manurial treatments.

314. SUMMERLAND (R. C. PALMER).

634/5

Results of experiments conducted at the Dominion Experimental Station, Summerland, B.C., 1932 to 1936, 1937, pp. 28.

This brief but concise and clear account of work at Summerland is full of interest to deciduous fruit growers. *Orchard soil management.* There is experimental evidence to show that Okanagan soils are frequently deficient in humus, nitrogen and boron. Where irrigation is available the use of leguminous cover crops is recommended to ensure sufficient humus. It is found that nitrogen is best applied in small amounts every year. Where drought spot and corky core of apples and gum spot of prunes indicate boron deficiency, the addition of 30 lb. per acre boric acid is suggested. *Irrigation.* Furrow irrigation is general. Notes on methods are given and it is suggested that summer irrigations should be carried on well into September to ensure satisfactory soil moisture conditions in the winter. *Improved fruits.* Introductions are discussed and it is noted that breeding is in progress with apples, pears, peaches, apricots and cherries in the attempt to get varieties particularly suitable for B.C. conditions. *Rootstocks.* Of the apple stocks Malling I (English Broadleaf Paradise) shows great promise, producing, when budded to McIntosh or Delicious, a medium sized, early bearing tree. It is comparatively hardy and resistant to collar rot. A number of named apple varieties are being tested for use as intermediates. *Grafting fruit trees.* The inlay graft, a modification of the bark graft, has been found extremely good for top working. "In this method starting from the end of the stub and cutting downwards, a small section of the bark, about $1\frac{1}{2}$ inches long and the same width as the scion, is removed so as to leave a notch which tapers slightly towards the base. The scion carrying

2 or 3 buds is made with a slanting cut across its butt. The cut surface is the same width and length as the notch into which it is pressed. To hold the scion in place . . . a small . . . nail is driven through the scion into the stock. . . . The union is prevented from drying out by coating the entire scion and stub with hot grafting wax or one of the commercial grafting emulsions." *Pollination.* No special difficulties are encountered. Brief constructive notes on interplanting are given. *Pruning.* Pruning for the modified leader type of tree is described. *Thinning.* This should be considered as a means of apportioning the number of fruits to the leaf area in such a way as to get fruits of the desired size. It will therefore vary in different apple varieties according to the ratio of leaf area to length of branch. Fruit size can be greatly increased in certain plums and the Italian prune at low cost by spur pruning in winter. Thinning of apricots is not recommended. *Harvesting.* Different varieties of apple give different indications in fruit size and colour and in seed colour of picking maturity. Pears can be best tested by the mechanical pressure tester. In cherries and prunes the determination of soluble solids by a refractometer is the most accurate method of determining picking maturity. In apricots and many plums fruit colour is the best indication. *Storage.* A few general notes are given. *Fruit products.* Notable work at Summerland includes processing of cherries, canning unfermented apple juice, apple syrup, glacéed apple chips and cider vinegar. *Vegetables.* The major problems undertaken on vegetables at Summerland have been those connected with irrigation, nutrition and varieties. Breeding has also resulted in the development of improved strains of tomatoes, peppers, corn, cucumbers and onions. *Ornamentals.* A note is made of many popular ornamental shrubs or plants which thrive under Okanagan conditions. *Tobacco.* Reliable data are available on varieties, cultural practice and curing procedure necessary to produce high grade tobacco under Okanagan conditions.

315. TEA RESEARCH INSTITUTE OF CEYLON.

633.72

Annual Report for 1936, being Bull 17, pp. 99, St. Coombs, Talawakele.

From the Report of the Agricultural Chemist. The C/N ratio of various materials available for use in composting is tabulated. The results of a complete investigation of the distribution of nitrogen, carbon and lignin in the raw materials and decomposed products of compost materials point to the fact that humus is a ligno-protein that releases its nitrogen only with difficulty, a finding at variance with the claims of ready availability of nutrients made for composted materials. The apparent discrepancy would be resolved, if in humus, ordinarily conceived to be the product of the compost heap, there were present in appreciable quantities nitrogenous substances which were not strictly humus at all. Loss of nitrogen during the process of composting ranges from 8.5% in an estate experimental heap to 46% under ordinary estate conditions, much of this greater loss being due to excessive rain in the later stages of manufacture. The effect of an average annual dressing of compost of 15 tons per acre for 4 years amply demonstrates the advantage to yield of liberal manuring of young tea. The effect on quality is now being tested. In manurial experiments now in their fifth year a substantial increase in yield due to nitrogen was in proportion to the quantity applied, the different kinds of nitrogen behaving alike to within 5%. Potash fails to influence yield but possibly improves quality. The cumulative effects of phosphatic applications are apparent for the first time, the higher dressing of 60 lb. per acre showing no superiority over 30 lb. per acre. From the Report of the Plant Physiologist. An experiment in the comparison of treatment of young tea is discussed. The treatments were: the planting of (a) 6-inch stumps, (b) seedlings from which leaves and green stems only had been removed with the subsequent removal of gourmandizers, (c) as (b) but the gourmandizers were not touched. A preliminary assessment suggests that it is preferable to bring young plants into bearing as early as possible. Dieback due to carbohydrate deficiency can be avoided by leaving a generous fringe of unpruned branches on the bush below the future tipping level. However, a form of dieback occurs even when the roots are full of starch and an investigation points to the possibility that the shot hole borer *Xyleborus* sp. may be responsible. The conclusion of the first 4-year cycle of the pruning experiment shows no significant difference attributable to pruning method. Reports from the Mycologist, Entomologist and other officers are also presented.

316. WARDLAW, C. W. 664.85 + 664.84 + 656.2
Tropical fruits and vegetables: an account of their storage and transport, being reprinted from *Trop. Agriculture, Trin.*, 1937, Vol. 14, Nos. 3-12, pp. 224, bibls. numerous, 4s. British, 4s. 6d. Foreign (from the Editor, *Trop. Agriculture*, I.C.T.A., Trinidad).

These articles on the storage and transport of some 150 fruits and vegetables, appearing first in *Trop. Agriculture, Trin.* (see also brief note on earlier articles in *H.A.*, 1937, 7 : 1081), have now been collected under one cover, where they form an invaluable manual on the subject. The successful cold storage of such commodities depends on a multiplicity of factors including variety, environmental conditions of growth, maturity when harvested, process of removal to store, temperature, humidity and duration of storage and time taken to distribute on removal from storage. Information when available is included on the above points. The author has not only drawn on his own extensive experience, but has utilized to the full the very scattered, published information on the different points. Moreover, to those wanting to pursue the matter further a list of references, given most usefully after each crop dealt with, provides ample opportunity for so doing.

SECOND IMPERIAL HORTICULTURAL CONFERENCE

POSTPONEMENT TILL 1941

It has been found necessary to postpone this conference until 1941. It is proposed to hold it in London in the summer of that year.

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